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The Simplon tunnel is now said to have been definitely decided upon, the negotiations between Italy and Switzerland for the conclusion of a convention betweeen the governments of the two countries having been concluded. By the terms of the agreement the Italian Government will grant a total subsidy of $330,000, the payment of which will be spread over a period of 99 years in annual contributions per kilometer of the line between Domodossola and the tunnel, a distance of 14 miles. The subsidies to be allowed by the Italian provincial and municipal authorities are fixed at a total of $800,000, but these are not guaranteed by the Italian Government. The heaviest work will be on the Swiss side, and this will be undertaken by the Jura & Simplon Ry. Co.

The solution of the Central Pacific Ry. and Union Pacific Ry. problem proposed by Senator Thurston, of Nebraska, is for the government to sell to the highest bidder its second mortgage claim to each road, requiring the purchasers to consolidate the lines so as to provide a through route from the Missouri River to San Francisco.

The report of Mr. W. J. Coombs, one of the receivers of the Union Pacific Ry., to the California Railway Commissioners, states that there should be an absolute payment of the debt and a dissolution of all connection with the government. It is considered possible to effect a reorganization of the main lines of the Union Pacific and Central Pacific railways upon a sound financial basis, including a payment to the government in cash of a very large percentage of its claim and leave investments in its securities safe and remunerative.

The average speed of the Empire State express on the New York Central R. R. is now 53⅛ miles per hour, while the average speed of foreign expresses is given as follows: England, 51.75 miles; Germany, 51.25 miles; France, 49.88 miles; Belgium, 45.04 miles; Holland, 44.73 miles; Italy, 42.34 miles; and Austria-Hungary, 41.75 miles.

A steel rail tramway for country roads has been proposed by Mr. John O'Donnell, of Lowville, N. Y., formerly State Railroad Commissioner, to facilitate traffic of wagons and other road vehicles. The rails are about ¼ in. thick and 5 ins. wide in the tread, with a rib or flange about ½-in. high on each side, the flanges also extending below the flat part of the rail, and being spiked to the longitudinal timbers upon which the rails rest. These timbers rest upon cross-ties on the subgrade of the road, and gravel or broken stone is filled in up to the level of the rails. The cost of finished road is estimated at $3,000 to $5,000 per mile, the latter being for a good macadam road. The timber and steel tramway is estimated to cost $2,500, the balance being for the paving.

A lift-span 421 ft. long is proposed for the new Kansas City & Atlantic R. R. bridge across the Missouri River at Kansas City, Mo. The bridge is to occupy masonry piers and abutments built some years ago, and will have two 421-ft. spans, one of which is the lift-span. For this lift-span steel towers will be erected on the piers, and the moving span or deck will move vertically up and down between them, its movement being effected by means of counterweights traveling up and down in the towers. The whole arrangement and operation is much like that of an ordinary window sash and its counterweights. It is calculated that eight men can operate the bridge by hand, and that the same can be accomplished mechanically by a small motor. The total lift of the span is 45 ft. They will provide for a double-track railway 32 ft. wide, a roadway 11½ ft. wide on each side of the railway, and a sidewalk 5 ft. wide on each side of the bridge, making the total width of the span 65 ft. The bridge was designed by Mr. J. A. L. Waddell, M. Am. Soc. C. E., Kansas City, Mo., and is in its general features similar to the bridge built by the same engineer over the Chicago River at South Halstead St., which was illustrated in the Engineering News of April 19, 1894. The plans are now before the Secretary of War for approval.

An A. B. Bowers hydraulic dredge suit has been commenced in the U. S. Circuit Court of Chicago against Linden W. Bates, who used one of Bowers's patented dredges on the Chicago drainage canal. John B. Brown, formerly President of the Western Indiana R. R. Co., joins with Bowers in the suit. It seems that Brown acquired the rights to the Bowers patent for Lake Michigan and the rivers and harbors opened into it; but a misunderstanding with Bowers arose, and the case went to the courts. Bates is now charged with having taken advantage of this legal tangle, and, under rights to build and use these dredges in Kansas City, Oregon, California and Washington, he used one on the Chicago Canal, and is building one for dredging at Memphis. Bowers and Brown now ask for a perpetual injunction and an accounting for the profits made at Chicago.

The most serious railway accident of the week was a rear collision between a regular and an extra freight train, at Dover, N. J., on the Delaware, Lackawanna & Western R. R. Dec. 15. There is a single track over the drawbridge crossing the Morris Canal, and the regular train (an eastbound cattle train) was held by signal to let a westbound train pass. The extra or second section was not properly flagged, and ran into the regular train, killing one man in the caboose and smashing a number of cattle cars.—A serious derailment occurred near Narrowsburg, N. Y., on the Erie R. R., Dec. 16. An east bound passenger train jumped the track, the engine, tender, three baggage cars and smoking car going down the bank, while the day car went partly over the bank, and four Pullman sleeping cars remained on the bank, although derailed. One man was badly hurt.

A crossing collision between an express train of the Union Pacific, Denver & Gulf R. R. and an electric car of the University Park line occurred at Denver, Colo., Dec. 14. It is said that the motorman was sitting down while the car was approaching the crossing. The car was smashed and the engine, baggage car and first day car were ditched. The motorman was killed and seven persons were injured, some seriously.

A locomotive exploded on the Southern Railway at Emory Gap, Tenn., on Dec. 13. The engine was standing on a side track at the time, in charge of the fireman, the engineer and conductor having gone to the railway office for orders. The fireman was seriously injured, as was also a bystander, who was 100 ft. away from the engine, and who was struck by a flying piece of iron.

An elbow in the main steam pipe leading to the starboard engine of the American Line steamer "St. Paul" burst on the morning of Dec. 18 while the steamer was at her dock, four hours before the time at which she was to sail. Five persons were killed and seven others severely burned. The engine is a six-cylinder, quadruple-expansion, four-crank engine, the arrangement of the cylinders being the same as that on the "St. Louis," described in our issue of Aug. 15. The two high-pressure cylinders are mounted tandem above the two low-pressure in the forward part of the engine room. The two high-pressure cylinders receive their steam through a forked pipe from the steam main, the stop valve being placed in the latter near its junction with the forked pipe. Below the stop valve is a large elbow, which is a portion of the main steam pipe leading from the boiler room. It was this elbow that burst. The engineers were in the engine room getting everything in readiness for the voyage, steam was raised in the boilers, and the jackets of the cylinders were being warmed up, but the main stop valve had not been opened. The only theory given at present to account for the accident is the usual one of water hammer, but investigation is being made by the steamship company at the hour of our going to press, and further details are not now procurable.

Steam pipe explosions are becoming alarmingly frequent. One took place on Dec. 11 in the engine room of the Pitts Agricultural Works at Buffalo, N. Y., injuring two men, one probably fatally.

A sawmill boiler exploded at Gordon, O., on Dec. 10, killing two men and fatally injuring two others. It is said to have been caused by negligence of the engineman..

A boiler exploded at the mine of Sands Bros., near New Athens, Ill., on Dec. 10, killing one man and injuring four. Weakness of the boiler from old age is said to have caused the explosion.

An explosion of nitro-glycerine occurred in the magazine of the Humes Torpedo Co., near Butler, Pa., Dec. 4, killing two men. About 1,000 lbs. of explosive were stored in the magazine, and it is supposed one of the men dropped a can on the floor.

The explosion of a lamp in the new water supply conduit of Allegheny, Pa., resulted in the death of an Italian who was painting the interior of the pipe. It is supposed he was so confused by the pain and the smoke that he was unable to get out, although only 50 ft. from a manhole. He died soon after being rescued.

A strike of the employees of the Union Traction Co., of Philadelphia, Pa., was started on Dec. 17. Violence was begun at once by the mob, and a large number of cars were stoned, smashed and derailed before adequate police protection was afforded.

The interest of the state of Maryland in the Chesapeake and Ohio Canal amounts to about $30,000,000; $20,000,000 of this total being represented by unpaid guaranteed dividends for 56 years and unpaid interest for 60 years. The state wishes to dispose of its interest, but up to this time the highest bid received does not exceed $1,500,000. The State Board of Public Works has again advertised it for sale on Dec. 23. The total length of the canal is 192 miles, extending from Alexandria, Va., to Cumberland, Md., generally following the Potomac River. It passes through a spur of the Alleghenies by a tunnel nearly a mile long. The floods of June, 1889, practically ruined the canal as a waterway, but its tow-path still has value as the road-bed for a railway. The West Virginia Central Railway Co. wants it as a seaboard outlet to its system; and the Baltimore & Ohio R. R. Co. is bidding for it to defeat competition by a parallel line. These two companies are the only bidders so far.

The Massachusetts Ship Canal Co., chartered in June, 1895, to cut a canal through Cape Cod, on the Bass River route, has failed to pay the prescribed $150,000 forfeit money within six months, and its charter consequently is null and void. The canal was to cost from $5,000,000 to $8,000,000, and to be finished in two years.

Bids for the removal and disposal of the kitchen garbage and dead animals of Philadelphia during the year 1896 are invited until Dec. 23 by Thos. M. Thompson, Director of Public Works; also for cleaning streets, inlets, and public market houses, the removal of ashes, sweepings, cut grass, household and store waste. Garbage disposal may be by means of "incineration, utilization, or by any other process, subject to the approval of the Director of the Department of Public Works," the work to be done in a manner "not prejudicial to public health." Kitchen garbage must be called for and removed from all buildings six times a week, only water-tight, covered metal carts being allowed for this work. Certain streets are to be cleaned six, three and two times daily, according to location and traffic, and others are to be kept continually clean between 7 a. m. and 6 p. m., including all asphalted streets. The garbage of the city is now disposed of by the Arnold reduction or utilization process, and by burning in Smith furnaces, built on the Siemens regenerative plan. There will be six districts in 1896, and bids will be received for doing the work in any or all of these. During the present year the garbage collection and disposal has been done under three contractors, the Philadelphia Incinerating Co., which has two burning plants with a nominal capacity of 200 tons each; the American Incinerating Co., which has a utilization plant, with a rated capacity of 150 tons a day, and the U. S. Fuel Co., which now hauls its garbage to the utilization plant. As the first two companies have invested large sums in their disposal plants, as only eleven days elapse between the date of advertising for and receiving bids, and as the contract is for only one year, it seems likely that the present contractors will secure the awards, or that, if they go to other parties, the garbage will be treated at the large and apparently successful plants already installed, although garbage disposal methods and contractors in the Quaker City seem to be as thick as "leaves on Vallombrosa."

THE CORNHOUSE BRIDGE, BERNE, SWITZERLAND.

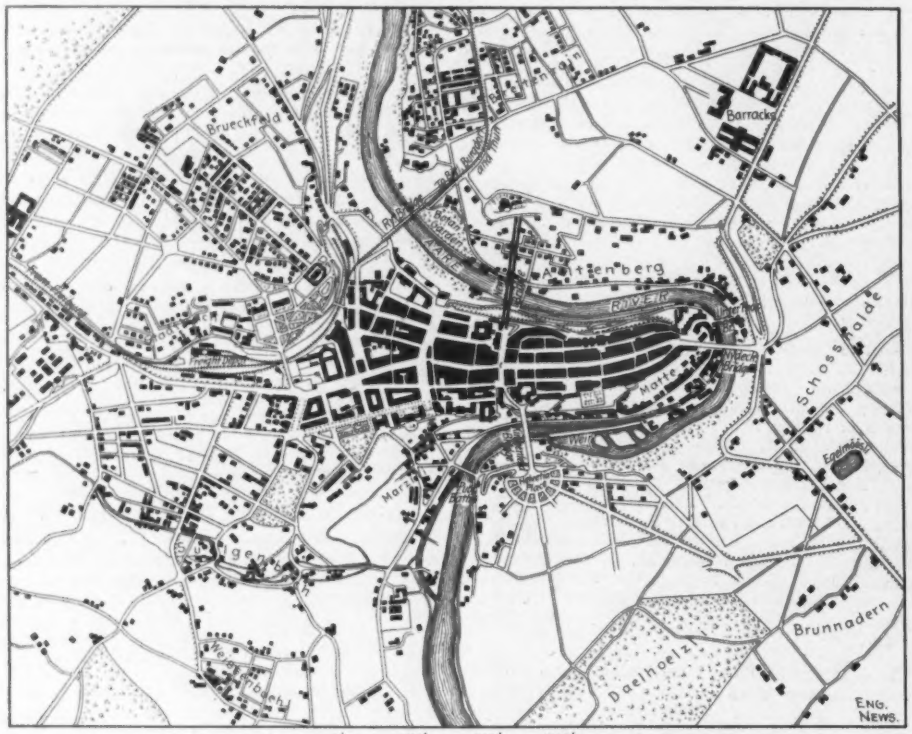
By Elmer L. Corthell, M. Am. Soc. C. E.

The city of Berne has many interesting features which attract the passing attention of tourists who spend here a day, not generally more, on their way from the resorts of Lake Geneva to Interlaken and other points. Berne is worthy of a much longer visit and more careful inspection than can be given to it in two or three hours. The bear pit, the old and unique arcades, the town hall, the grotesque street fountains, the old clock tower with its hourly movements of curious figures, the Federal buildings, the beautiful view of the Bernese Alps and the drives and walks about and out of the city are not fully appreciated by the tourist who is hastening on to the more popular resorts, which occupy more pages in his Baedeker. The writer in a residence of seven months recently in Berne found much there of interest from an engineering point of view.

The accompanying map of the city shows its peculiar topographical conditions in relation to the River Aare, which makes a peninsula on which the city is built. The city was well located for defense in the medieval ages and later periods, but the restricted area led to congestion of population, and then from time to time to the construction of bridges over the Aare, in order to develop the beautiful rolling country across the river. Little is now left of the city of the Middle Ages. The foundation, with its chiseled date of 1204, of the old Nydeck castle, is still found near the extreme point of the peninsula, and near it is the first bridge, built of rough masonry arches. Just above this is the beautiful Nydeck bridge, built in 1844, with one arch spanning the entire river; the length of this span at the spring line of the arch is 168 ft., and the height above the water at the center of the arch is about 100 ft. The location of these two bridges is shown on the map, and an excellent photograph of the two is reproduced.

In 1882 the Kirchenfield bridge was built (see map), to develop an outlying district of that name. This bridge is 751 ft. long and 115 ft. above the water. Its two beautiful arches attract much attention. The photograph of this bridge is also reproduced. It has one defect, in that it lacks rigidity of the floor system; the main arches are also liable to some deformation in the passage of heavy loads on account of the weight being carried to only a few points of support on the arch.

The only means of direct access to the country north of the city is by way of the railway bridge shown on the map, called the Lorraine bridge, as it leads to a suburb of that name on the opposite bank of the river. A view of this bridge from a photograph is given looking up stream towards the projected Cornhouse bridge, with the grand and beautiful Bernese Alps, 50 miles away, seen in the distance. Under this railway bridge, which is a deck bridge, is a quite narrow passageway without sidewalks for street traffic. It has now become quite necessary, with the growth of the city, to build another and more conveniently-located bridge for the city traffic. During the last year the question of location and character of the structure has been under careful consideration, as well as the questions of ways and means and the distribution of the cost. The project has at last been brought to the point of construction. The cost is to be divided between four parties—the Federal Government, the canton of Berne, the city of Berne and the Burgher Association.



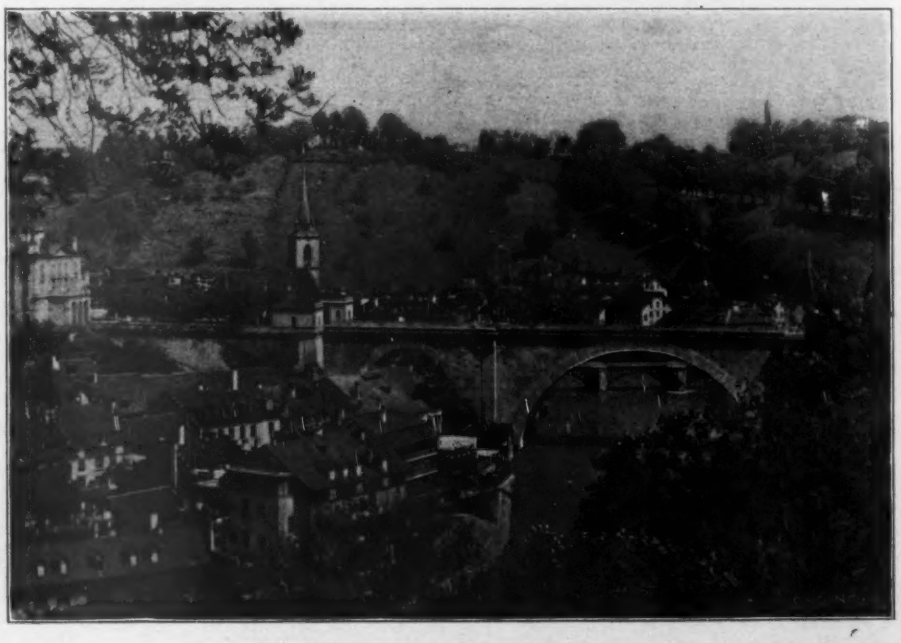
MAP OF CITY OF BERNE, LOOKING NORTH.

The referendum method is used on all main questions connected with works of this kind, so that after the engineers have studied and reported upon the location to the City Council, and the latter has approved, the question then must be submitted to the popular vote. When the location has been finally determined upon by this method, the plans must undergo the same trial of public favor or disfavor. It will at once be seen that the ultimate decision may not always be the wisest, as popular knowledge of technical questions is not greater among the citizens of Berne than it would be in any city of the size in the United States. However, the project has successfully passed this ordeal, and a beautiful structure has resulted, due to the skill of the City Engineer, Mr. Hugo de Linden, who designed the structure. He is also on the International Board of Engineers, who were selected to pass upon the plans after the general plan had been decided upon by means of the referendum. The council decided to have an international competition on the basis of the general plan adopted. The writer, who was in Berne at the time, ascertained the cost of iron railway and street bridges in Switzerland, and decided to enter into the competition for the purpose, if it should be possible to associate with himself one of the United States bridge companies, and thus to give our people an opportunity to build a monumental structure in the heart of Europe. He opened communication at once with the Phoenix Bridge Co., as a representative American company of high standing. The preliminaries were well advanced in the study of the subject, when some serious obstacles arose, due in part to the Swiss custom laws and in part to the low price of iron and steel structures in Germany at the time.

The writer desires particularly in this communication to bring out the very careful and thorough methods employed to obtain the best plan. The data of various kinds were prepared in great detail, printed, lithographed and sent out to various countries to those who desired to enter into competition. These data were as follows:

1. The conditions of the competition drawn up by the International Board, consisting of the following well-known engineers of high standing: W. Lauter, Frankfort, Germany; Ed. Locher, C. E., Zurich; Prof. W. Ritter, Zurich Polytechnic School; Prof. Conradin Zschokke, Zurich Polytechnic School, and Mr. F. Lindt, Directing Engineer of the city of Berne.

2. Six detail plans: A, a situation plan; B, longitudinal profile; C, Very complete cross-sections covering the entire ground; D, Complete general



NYDECK BRIDGE, BERNE, SWITZERLAND.

project in plan and elevation; E, Details of the main piers; F, A variation plan of the general project.

3. A description of the material in which the foundations will rest.

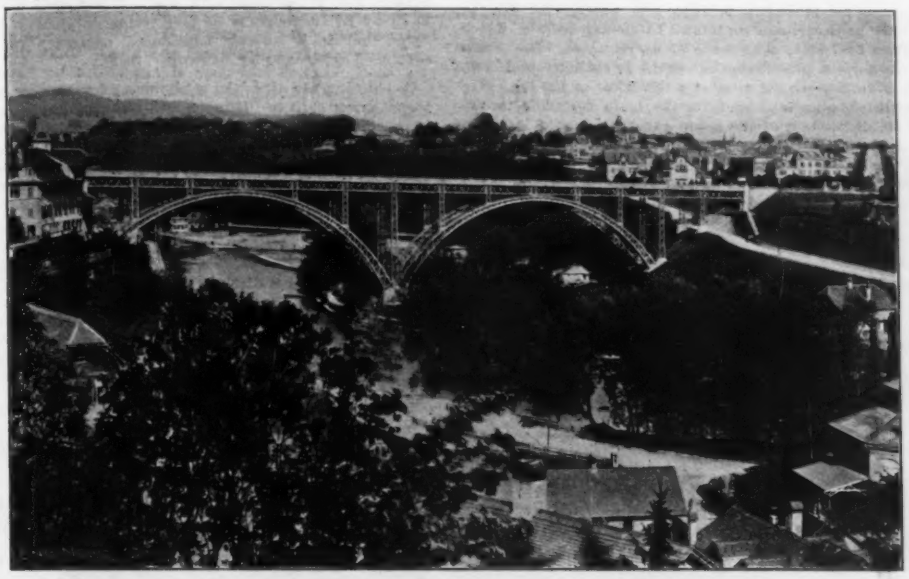
4. The general law in regard to bridges.

5. The ordinance in regard to the execution of masonry work.

6. An ordinance in regard to the execution of structural work, iron or steel.

7. Tabulated blank form for proposals.

The conditions as to soil on the Cornhouse or city side of the bridge are peculiar. Many years ago Berne was nearly destroyed by fire. In removing the rubbish it was hauled to the Corn-



VIEW OF KIRCHENFELD BRIDGE, BERNE, LOOKING EAST.

house Square and dumped over the bank of the river. The test pits sunk in the bridge approach show how deep this material is, and the depth of unstable material to be penetrated in putting down the approach piers This material indicated by the profile is as follows: The filling of rubbish from the fire is over 50 ft. thick; then comes loam about 15 ft. and then loam with coarse sand and gravel about 25 ft., and then gravel down to the molasse, a geological formation of great depth found in Switzerland.

In the plans submitted to the vote of the people was a well-conceived cantilever structure designed by Mr. Probst, an engineer of prominence in Berne. With some easily-made modifications, increasing the length of the central span a few feet and consequently the south arm of the cantilever, all deep foundations in the unstable material above mentioned could have been avoided, and the structure would have cost less than the arch bridge; but the massive piers of this arch bridge, coupled with the recollection on the part of the voters of the unstable Kirchenfield bridge without piers, with no doubt the supporting opinion of the City Engineer and the Council, led to the adoption of the arch plan by a very large majority. Mr. Probst's plan is shown in connection with the arch plan as then worked out, though considerably modified since. Any stable pier set into the filling shown on the South end of the bridge must necessarily go below all such material, requiring a pit in unstable material about 100 ft. deep.

The accepted and adopted plan is shown by the perspective view. It is cetrainly a beautiful and suitable structure, which American engineers will be glad to examine during and after its construction. The dimensions, modified somewhat by the international competition, are as follows:

The total length of the structure is about 380 meters (1,247 ft.); the total height at the center of the arch, from bed of river to surface of roadway, is 48.7 meters (160 ft.); the length of the middle, or main, arch, from center to center of arch, is 112.5 meters (358 ft.); the height of the arch, from the spring-line to the center of the chord, is 33.5 meters (110 ft.); the width of the roadway and sidewalks is 12.6 meters (41.5 ft.); other general features are shown by the general view. The competition was confined to Switzerland, Germany and Italy; the French could not compete, on account of the present discrimination in customs against that country.

The contract, which was signed about the middle of August, is with the stock company of the manufactory of Theodor Bell & Co., at Kriens, Canton of Lucerne, and Mr. Paul Simons, C. E., of Berne, with the assistance of the Guetehoffnungsnuette Company, of Oberhausen, Germany, who have recently obtained the contract for the great bridge at Bonn, illustrated in Engineering News of Aug. 8.

The work is to be entirely completed for the lump sum of 1,746,000 francs ($336,978), of which 50% is for foundations and masonry and 45% for the iron, the weight of which is 1,738 metric tons (1,000 kilos equal 2,204.6 lbs.), 3,831,595 lbs.

The plans which secured this contract were brought forward by Messrs. Arthur and Hermann, of Bonstetten, and Mr. Heurs de Fischer, architect, of Berne, in association with Mr. Simons and the manufacturers above mentioned. The work was let for about 60,000 francs below the estimate of Mr. de Linden, the engineer. The work is to be begun at once and prosecuted with vigor to completion.

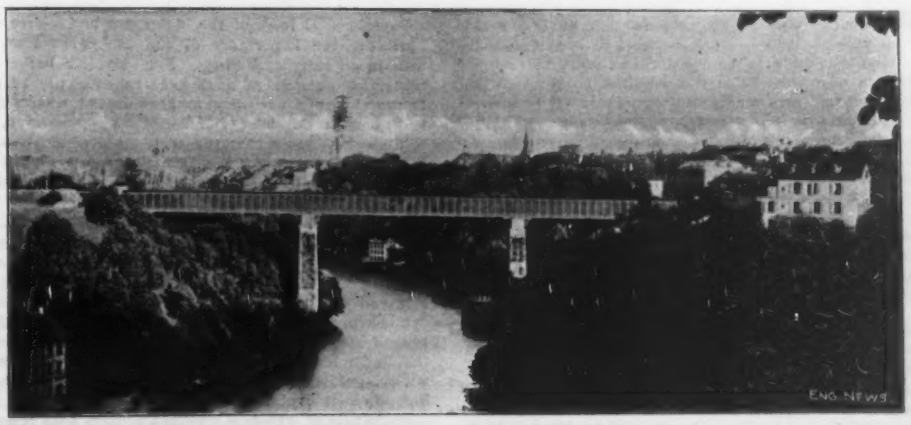
In order that it may be seen whether or not, on the basis of the prices, United States firms could have competed successfully, some of the details will now be given: First, as to the present actual cost of steel structures in Germany. The prices on the Bonn bridge, recently let and above alluded to, will give, perhaps, the most reliable information, supplemented by some recent data obtained by the writer from a reliable source.

The weight of the entire superstructure of the Berne bridge was 3,113.8 tons (metric), the total cost of the superstructure, 1,074,000 marks, equivalent to $255,612, or 3.7 cts. per pound.

The cost of iron bridges (not steel) on the Jura-Simplon Railway, in Switzerland, is 3.3 cts. per lb. erected; the average cost of the viaducts and other iron bridges on the St. Gotthard is 3.7 cts. per lb. Coming now to the Berne bridge, it should first be stated that the Swiss customs are somewhat peculiar, and must be taken into careful account, as they bear importantly upon the question of cost. The custom duties are very high for riveted work, or even for work with rivet holes only, or in a similar state of preparation, while a very low tariff belongs only to rolled iron, without any further preparation, so that from Germany and Italy, which are adjacent countries, manufacturers can ship material direct from the rolling mills to the bridge works, or to some shop near the works, and there have the holes punched and bored for the field work. The custom duties for finished material amount to about 0.35 cts. per lb. On the basis above stated of cost of the Berne bridge, and assuming that the cost of the iron structure is 45% of the total amount, then the superstructure will cost $151,640, or 3.96 cts. per lb. erected.

The most important question, however, is that of the cost of transportation from the United States to Berne. The steamship companies will give a rate from New York or Philadelphia to Antwerp of $4 per net ton of 2,000 lbs., equivalent to 0.2 ct. per lb. The rate from Phoenixville, including the haul on the railway, to either of the following ports —Antwerp, Havre, Marseilles and Genoa—is equivalent to 0.3 ct. per lb. The rates from these four ports to Berne varies somewhat, the lowest being from Antwerp, equivalent to 0.26 ct. The total rate, therefore, from New York or Philadelphia to Berne is 0.46 ct. per lb., or from Phoenixville to Berne 0.56 ct. per lb. Deducting from 3.96 cts. per lb. the price of the erected iron superstructure at Berne, 0.35 for customs and 0.46 for freight from New York or Philadelphia to Berne, we have 3.15 cts. to cover the cost of manufacturing, loading at New York or Philadelphia, unloading at Berne, hauling one kilometer (0.62 mile) to the bridge, erecting and painting.

With the price of iron and steel in this country as existing in April last, no doubt a competition would have been possible. Whether or not it is now possible, can best be judged by our manufacturers, as the prices are fluctuating and generally moving upwards.



LORRAINE BRIDGE, BERNE, LOOKING SOUTHEAST; BERNESE ALPS IN THE DISTANCE.

The writer confesses to an ambition to see, in the near future, United States bridges erected in central Europe or countries near it. The general tendency toward lower cost of iron and steel bridges in this country, due to reduction in cost of all the processes from the ore to the finished material by the economies brought about by machinery will soon enable us to compete with continental manufacturers on their own territory and in the markets where they now have a complete monopoly of the business.

AIR-BRAKE EQUIPMENT FOR RAILWAY CARS.

At the meeting of the New England Railroad Club, on Nov. 12, Mr. R. A. Parke read a paper on "Air-Brake Equipment and Its Application to Rolling Stock," in the commencement of which he showed that at the close of the freight-train brake trials nine years ago it seemed as though only an electro-pneumatic brake would meet the requirements of the time, but that within a year the old air-brake was transformed into the quick-action air-brake by modifications of great simplicity. Since that time, the adoption of the quick-action brake has enabled the railways to dispense with many brakemen and to increase the speed of the trains.

The remarkably fast time which has become an established element in practical passenger service within the past three or four years has developed a demand for even a better stopping efficiency than that assured by the ordinary quick-action brake, and this requirement has instigated a modification of the quick-action brake apparatus, which decreases the length of stops from high speeds about 25%.

While practically the same frictional resistance to the rotation of the wheels is required at all speeds to induce them to slide upon a dry rail, the same brakeshoe pressure produces much more friction at low speeds than at high speeds. It has therefore been customary to so limit the maximum brakeshoe pressure that the friction developed at low speed shall not be sufficient to cause injurious wheel sliding. The total friction at any instant is the direct measure of the resistance which is then retarding the motion of the train, and a uniform brakeshoe pressure therefore offers much less resistance to the motion of the train at the high speed in the beginning of a stop than at the low speed toward the end. It is evident that a much greater brakeshoe pressure could be employed at high speed than at low speed without sliding the wheels, and this is the purpose of the modification of the quick-action brake, which is now known as the "high-speed" brake.

The high-speed brake is essentially a quick-action air-brake operating under a high air pressure. In emergency applications, it creates at first a high brake-cylinder pressure, which is gradually and automatically reduced to 60 lbs., while the speed is being reduced, and in service applications it limits the cylinder pressure to 60 lbs. These results are effected by the use of an automatic relief valve, which is attached to each brake-cylinder, and consists of a piston, a slide valve and an adjustable spring. The spring is so adjusted that the valve is inoperative when the air pressure in the brake cylinder is 60 lbs. or less. If, after the cylinder pressure has reached 60 lbs., the supply of air to the cylinder continues, but with no greater rapidity than occurs in any service application of the brakes, a large port in the relief-valve is opened and permits the excess supply of air to freely discharge from the brake cylinder to the atmosphere, so that no increased cylinder pressure occurs. In an emergency application of the brakes, however, the air is supplied to the brake cylinder so rapidly and in so much greater volume that the pressure rapidly rises above 60 lbs., and causes a longer travel of the relief valve piston, whereby the large port of the relief-valve merely opens and instantly closes again, and the air is caused to escape from the cylinder to the atmosphere through a more restricted port, until the pressure has been thus reduced nearly to 60 lbs., when the further escape of air is cut off and that pressure is retained in the brake cylinder until the brakes are released from the locomotive.

As locomotives which haul high-speed trains are generally also used in other kinds of service, it may be frequently necessary to change from the standard train pipe pressure of 70 lbs. to the high pressure, and vice versa. In order that this change may be quickly effected, the feed-valve attachment of the engineer's brake-valve is removed and replaced by a flanged fitting, from which two small pipes lead to a bracket under the running board. This bracket supports two feed-valves, the one set at 70 lbs. pressure and another set for the higher pressure, and contains a three-way cock by which either feed-valve may be used as required. The pump governor is also supplied with a siamese and two diaphragms, one set at 90 and the other at 120 lbs. The small air pipe leading from the main reservoir to the 90-lb. diaphragm of the pump governor is supplied with a cock, which is opened when a main reservoir pressure of 90 lbs. is used, and closed when the higher pressure is required. The train-pipe pressure used with the high-speed brake is from 100 to 110 lbs.

Experimental tests of the high-speed brake have demonstrated the importance of the use of sand on the rails in all emergency stops. Not only is a better stop made, but in case of a slippery rail the use of sand is practically a necessity to prevent the wheels from sliding with the high cylinder-pressure employed. It is highly desirable that the application of sand should be automatic, so that the movement of the handle of the engineer's brake valve is all that will be required of the engineer in emergencies.

Besides shortening emergency stops about 25%, another important advantage in the use of the high-speed brake is the ability to make more than one effective application of the brakes without recharging. Still another advantage is the positive limitation of the brake cylinder-pressure to 60 lbs. in all service applications, regardless of the train-pipe pressure used. Although the brake leverage is such that a cylinder-pressure of 60 lbs. produces a 90% braking power, and this braking power is available in full service applications, not a single pair of wheels is reported to have been removed from the Empire State Express trains on account of flat spots during the two years that those trains have been equipped with the high-speed brake apparatus.

An influential factor in the improved stopping efficiency under present air-brake practice is the general use of brakes upon the driving wheels. The driver brakes of consolidation and mogul engines are generally very effective, because such a large portion of the total weight is utilized as a braking force. The driver brake of a ten-wheel engine acts upon only about 75% of the total weight, and the eight-wheel engine, which is the one most used for fast trains, affords the driver brake the poorest stopping power of all. The eight-wheel engine with driver brake only is in precisely the same position as was the 12-wheel car a few years ago, when brakes were applied to only eight wheels; that is it is supplied with but two-thirds the retarding power that it ought to have. The general reorganization of passenger brake gear, already mentioned, has happily included the application of brakeshoes to the middle pair of wheels of six-wheel trucks, so that few 12-wheel cars are now running without brakes for all wheels. The prejudice which formerly existed against the use of brakes upon wheels of the engine truck has been exploded, with the result that many of the engines used in fast passenger service are now equipped with brakes upon the leading truck. Just as it is to-day generally acknowledged to be a dangerous practice to operate passenger trains without locomotive driver brakes, it may safely be predicted that in a very short time it will be equally well recognized that a reasonable regard for safety requires the use of the engine truck brake. The promptness with which it has been applied to many of the engines of fast trains sufficiently indicates that it is already considered necessary to the safety of that class of passenger traffic.

Concerning the air-brake equipment of passenger cars, there appears to be little to add to what has already been said. There is one feature, however, which deserves consideration. The 10-in. brake cylinder was adopted for passenger car service at a time when it appeared that 50,000 lbs. was the weight of the heaviest eight-wheel passenger cars that were likely to be built. The weight is now in many instances more than 60,000 lbs., and in some cases more than 70,000 lbs. In order to apply a sufficient braking power to these heavy cars, it has been necessary to increase the brake leverage to such an extent that an excessive increase of piston travel accompanies a small wear of the brakeshoes. To meet the requirements of the heaviest 12-wheel cars, a brake apparatus which included a 14-in. cylinder, was designed some years ago, and its use upon heavy eight-wheel cars has the advantage that no additional complication in brake apparatus is introduced, and no increased stock of repair parts is necessary. There has, however, been a demand in some quarters for an intermediate size of brake cylinder, and the design of a 12-in. cylinder apparatus is now about completed. The chief disadvantage under which the work of applying the air-brake to freight cars is usually carried on, is the scanty room beneath the car in which to do the work. It is rare that the tracks used for car repairs are provided with pits, and the advantage of elevating one or more of the repair tracks for this purpose can therefore hardly be overestimated. It is an exceedingly simple matter to raise the track from 2½ to 3 ft. and thereby very greatly facilitate the application of the air-brake apparatus and all changes in the brake gear. It has been satisfactorily done by placing 12-in timbers longitudinally beneath the rails and constructing a short inclined approach. The space between the timbers is free of obstruction, so that the men move freely about under the car and stand up at their work.

In the past, the chief obstruction to the control of freight trains by the air-brake has been the difficulty of securing a sufficient number of air-braked cars; one of the difficulties now frequently encountered is the inability to make use of all the air-brakes present in trains. It is not infrequently found necessary to cut a portion of the brakes out of service upon freight

PROJECTED CORNHOUSE BRIDGE AT BERNE

Arthur & Hermann, Bonstetten, and Heurs de Fischer, Berne, Designers; Theodor Bell & Co., Kriens, Lucerne, and Paul Simons, C. E., Berne, Contractors.

trains, because it is impossible to maintain the air-pressure in all of them. This is in some cases due to the use of small air pumps upon the locomotive; and too much cannot be said of the importance of using air-pumps of sufficient size to preserve the proper air pressure and to maintain a liberal margin of excess pressure in the main reservoir without too much labor. An air pump of large capacity cannot, however, be expected to maintain the proper air pressure in apparatus which is so carelessly applied or maintained that a considerable portion of the air compressed escapes through leaky joints. The constant vibration of cars while in service requires that all air pipes and apparatus should be so firmly secured to the car body that no shaking or rattling of the parts is possible. The most efficient service of the air-brake upon freight trains will never be realized until proper facilities for inspection and repairs are provided. Inspectors are often not supplied with suitable tools to do the work, and brakes are frequently cut out of service upon cars because of leaks at pipe joints or unions, which could be quickly remedied if the proper tools were at hand. Inspection plants at inspection points are a practical necessity. A sufficient number of tracks at such points should be equipped with a supply of compressed air, so that all cars may readily be tested under the proper air pressure. Where such compressed air plants have been installed, the inspection of the air-brake is systematic and thorough, while it occupies little more time and requires little, if any, more of an inspection force than where it is neglected. The use of separate tracks for inspection of air-braked cars also possesses the advantage that, when trains are made up, a sufficient number of air-braked cars may be removed together and placed at the head end of trains, without the trouble and delay at shifting.

This paper was followed by one on the same subject by Mr. E. G. Desoe, from which we take the following extracts:

I would recommend the placing of a conductor's valve, and air gage, in freight cabooses, that the conductor may observe the train line pressure, and stop the train by the use of the valve before the pressure gets so low that it cannot be stopped by the air-brakes, as might be the case if a stop-cock had worked closed, or some other stoppage occurred in the train line, and the air leaks off in rear part of train slow enough not to set the brakes. The use of a conductor's valve and gage in a caboose is only available, of course, when all the train is equipped with air-brakes.

Another thing of great importance when equipping freight cars with air-brakes, and one hand wheel used (and I would recommend the use of only one), is to have it work with the hand-brake; that is, when the air-brake is applied, instead of its pulling the chain from the brake staff; it should push it up to it. This is of importance, because when equipped wrong it is dangerous for trainmen to use the hand-brake; while when equipped right there is no danger for the trainman, and when used in connection with the air adds to its power, and gives an increased brake power.

I think a freight car should be equipped so as to have a brake power of 90% of its light weight, on account of there being so much difference in the weight of an empty and a loaded car.

Some time ago I made some tests to ascertain the loss by friction when the hand-brake was used, and found that on a car equipped with a single hand-brake there was a loss of 9% between the brake staff and shoes; on a car with a double hand-brake, one wheel, a loss of 16%, and on a car equipped with a double air-brake and one hand wheel, connected through rod to extended cylinder lever, a loss of 20%. Thus it will be seen that our hand-brakes, as usually arranged on freight cars equipped with air-brakes, do not have the same brake power on each truck, as they should, and that there is quite a loss by friction. As some of you may say that with the air-brake there is no need of so good a hand-brake, I will say that in the short time we have been using the air-brake I have known of several cases, on account of air pump out of order, broken train line pipe under tender, or insufficient brake power with the air-brakes, that the hand-brakes on the air cars were obliged to be used, either in connection with the air or alone, to control the speed on a heavy descending grade. Such cases as these are where we need efficient hand brakes, and those that work with the air, so that a trainman will not hesitate to use them, as he surely will when he finds there is a chance of its yanking him off.

In the discussion, Mr. B. J. Graham referred to the Graham truck, in which the tilting motion due to the application of the brake is aimed to be prevented by the use of an equalizer brake-bar, by which the downward pull of the front wheel and the upward push of the rear wheel are so equalized as to hold the truck frame steady.

A COMPRESSED-AIR POWER TRANSMISSION PLANT IN CALIFORNIA.

(With Inset.)

We illustrate on our inset sheet this week one of the most interesting examples of a power development and transmission plant that has for some time come to our notice. The plant is now being erected for the North Star Mining Co., at Grass Valley, Cal. Its novelty consists in the use of compressed air for transmission instead of electricity, which is in such popular favor, and in the design of the air compression plant, which contains among other features the largest Pelton wheel ever built.

The power is obtained from water conveyed about five miles in a 20-in. steel pipe from the South Yuba Canal to the power house in Boston Ravine, giving a head of 775 ft., or a static pressure of 335 lbs. per sq. in. The pipe is a continuous riveted conduit, with no allowance for contraction or expansion. At the lower end, where the pressure is greatest, No. 5 steel plate is used, and its remarkable toughness is admirably shown by Fig. 1, which is reproduced from a photograph of a test-piece subjected to cold bending.

The pipe has a capacity sufficient for 1,000 HP., which will eventually be used; and notwithstanding the immense pressure upon it, it is now "bottle tight."

The water from this conduit drives a Pelton wheel 18 ft. 6 ins. diameter, built somewhat like a bicycle wheel, but with trusses to carry the power from rim to hub, as shown in the photographs. It is to run at 110 revolutions per minute.

The wheel is mounted on a 10-in. shaft connected direct to two compound air compressors with cylinders 18 and 10 ins. diameter and 24-in. stroke, to give a piston speed of 400 ft. per minute. The air is compressed to 30 lbs. in the initial cylinders, which heats it to about 160° F. It is then carried through the intercooler lying in the wheel pit. This consists of 50 1-in. copper pipes 18 ft. in length. The water from the wheel dashes over these pipes and cools the air down to its own temperature by the time it passes into the second cylinder. Here it is further compressed to 90 lbs. pressure, and it then passes out through a 6-in. pipe about 1,000 ft. to a receiver in the shaft house at the mine. From this receiver the air is led through a reheater, composed of a system of pipes placed in a furnace and so arranged as to have all the air pass over a heated surface, raising its temperature to about 350° F. and increasing its volume about 43%.

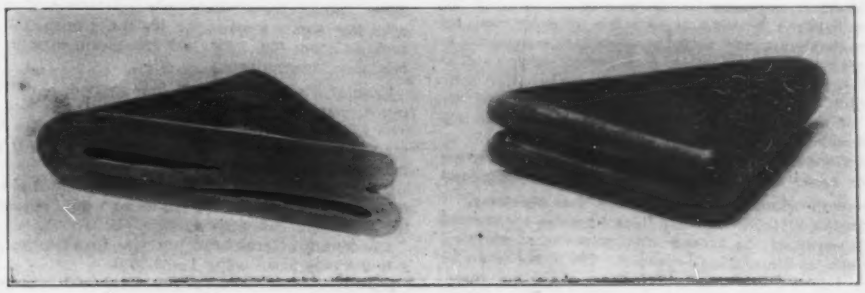


FIG. 1. COLD BEND OF A TEST PIECE FROM No. 6 STEEL PLATE FOR CONDUIT OF NORTH STAR MINING CO.

Thence for hoisting work it passes into the high-pressure cylinder of a cross-compound, direct-acting Corliss engine, built with slightly enlarged ports and jacketed cylinders. It leaves this cylinder at a temperature of about 130° F., and goes to another reheater, where the temperature is raised again to 350° F. Thence it passes to the low-pressure cylinder of the engine. It is exhausted from this cylinder into a brick flue, which conveys it to the offices and change house, where it is at last turned loose to warm and dry the miners.

For pumping from the mine, a compound differential pump, of a capacity of 600 gallons per minute at 500 ft. lift, is used. The air for the pump is reheated and sent down the shaft in a magnesia-covered pipe, but is not reheated between the cylinders, which allows it to be discharged into the shaft at a comfortably cool temperature. The air is also used for the drills in the mine.

It is expected that the compressors will deliver sufficient cold air at the shaft to develop 175 HP. if used cold, and $3 per day will pay for the fuel for reheating the air sufficiently to produce 250 HP. The water for power costs the company about 1 ct. per 1,000 gallons, or $6.50 per cu. ft. per sec. per day. Including the cost of fuel for reheating, this will make the cost of the "raw material" for developing the power almost exactly 10 cts. per horse-power per day of 24 hours, or, say $30 per month. The expense of attendance, oil, repairs, interest, etc., will probably not exceed $5 per horse-power per month. This expense for power may seem high to those accustomed to Eastern prices for steam or water power, but it must be remembered that both fuel and water are scarce and dear on the Pacific Coast.

There is at the shaft a boiler plant which can be fired up in case of accident to the water or air plant, and steam can quickly be turned into all the air motors, so that the mine may not be shut down.

The pipe was made and laid by the Risdon Iron Works, of San Francisco. The wheel was installed by the Pelton Water Wheel Co., of San Francisco, from designs by Mr. E. S. Cobb, and was made of this large diameter to give proper piston speed to the air compressors under the high head in this case available. The novel design of this wheel is an excellent example of the facility with which the Pelton wheel can be adapted to varying conditions of head power and speed.

The water is delivered to the wheel through a Pelton variable nozzle which, by an ingenious automatic device, controls the amount of water applied to the wheel according to the power required at any given time, maintaining a uniform speed, as well as a uniform pressure in the receiver, stopping and starting the wheel as the pressure increases or falls below the standard. By this means the greatest possible economy of water is obtained, as well as safety and uniformity of operation. The power of water under such head, as well as the efficiency of the Pelton wheel (85% being guaranteed), is shown by the fact that a nozzle tip only 1½ ins. diameter is required to run this entire plant..

The compressors, engines and reheaters were designed by Mr. E. A. Rix, of San Francisco, and were built by the Fulton Engineering & Shipbuilding Works. The pump was furnished by the Dow Steam Pump Works, of San Francisco. The entire plant as a whole was planned and executed by Mr. Arthur De Wint Foote, M. Am. Soc. C. E., and we are indebted to him for the above description and for the admirable photographs from which our illustrations are prepared.

Bicycles transported in baggage cars may be taxed outside of the fare paid by the owner, according to a recent action of the Passenger Committee of the Trunk Line Association. The number of wheels certain lines are called upon to carry has become so great that the baggage space available is taxed to the utmost, and sometimes to the exclusion of regular baggage. It is argued that a bicycle is not a piece of baggage in the usual acceptance of that term, but is freight, and should be paid for as such. Each railway company, however, is left free to act in the matter as it sees fit.

THE PROPORTIONS OF HIGH-SPEED ENGINES.*

By John H. Barr,** M. Am. Soc. M. E.; F. F. Gaines and H. E. Williams.

It has occurred to the writer that it might be possible to derive formulas which would express, more or less closely, the general conclusions arrived at as the result of experience in engine construction. These formulas are necessarily empirical in the sense that they are adjusted to agree with observations; but they should be, whenever possible, rational in form. That is, the variables should enter the formulas as they would enter purely analytical formulas; while the constants would be derived from practice, and not from assumed working strength, bearing pressures, etc. In other words, the engine in actual operation takes the place of the laboratory testing machine in supplying data for design.

The advantages of using expressions of the rational form, rather than purely empirical formulas, are: first, that working stresses, factors of safety, etc., can be deduced from their constants, and that these constants can be intelligently modified to meet new conditions; second, that they can be applied with greater safety somewhat beyond the range of data from which they are obtained.

Data for the examination of high-speed engine proportions, as described in this paper, were obtained from leading engine builders, who furnished blueprints, and filled out a blank form with the dimensions.

The data obtained in this way were quite complete, covering about 75 engines of about twelve different builders, the sizes of engines ranging from 25 to 225 rated HP. The information thus obtained was first classified and arranged for comparison. Thus, for example, in the examination of crank-pin dimensions, the engines with overhanging cranks were separated from those with inside or center cranks, while in dealing with piston rod diameters such a division is not necessary.

The following notation is used throughout this paper:

D = diameter of piston; A = area of piston; L = length of stroke; S = steam pressure, taken at 100 lbs. per sq. in. above exhaust, as a standard pressure; HP. = rated horsepower; N = revolutions per minute; C = a constant. All dimensions in inches, unless stated to the contrary.

The general method employed in deriving the various expressions may be illustrated by reference to that used for the diameter of the crank shaft at the main bearings.

Crank Shaft.—The formula for the diameter of a shaft which is subjected to torsion is:

$d = C \sqrt[3]{HP. \div N}$; if the moment of torsion is constant.

Crank shafts are subject to variable combined bending and twisting moments; but these moments, when their magnitude and variation are known, can be reduced to an equivalent twisting moment; hence an expression of the above form applies to the case in hand, if the ratios between bending to twisting moments and between maximum and mean moments are constant. In the engines examined, there is a general agreement as to these ratios. In the center-crank engines, the ratio of crank throw to distance between bearings and the ratio of maximum to mean moments are approximately the same.

From the data at hand, points were plotted on cross-section paper with given values of d as ordinates, and the corresponding values of $\sqrt[3]{HP. \div N}$ as abscissas.

From the equations of these lines formulas are derived which represent the average and extremes of practice, as shown by the engines examined. The three formulas thus obtained differ only in the values of the constants.

The constants found as above give:

$d = 7.56 \sqrt[3]{HP. \div N}$ for the mean.
$= 8.76 \sqrt[3]{HP. \div N}$ " " maximum.
$= 5.98 \sqrt[3]{HP. \div N}$ " " minimum.

Piston Rod.—The expression derived for the diameter of piston rods is based upon the Euler formula for a long strut, and is,

$$d = C \sqrt[4]{D^2 L^2} = C \sqrt{D L}.$$

Plotting the values of d given by the data as ordinates, and the corresponding values of the radical $\sqrt{D L}$ as abscissas, the equation of the mean line gives 0.145 as the value of C, while the extreme lines give 0.119 and 0.177 as the minimum and maximum values, respectively.

Connecting rods are first treated as long struts, then the allowance for flexure stresses due to inertia is examined. For resistance to buckling in the plane of motion, the connecting rod is treated as pin connected, or round ended; for flexure in a plane at right angles to this, the strut is square ended. Hence (neglecting inertia) the thickness, or breadth (b) of a rod of rectangular midsection should be one-half the height (h). The formula for breadth is: $b = C \sqrt{D L'}$, in which L' is the length of the rod.

The data examined give 0.0545 as the mean value of C, with 0.0433 and 0.0693 as the minimum and maximum values.

The excess of h over 2 b may be considered as a provision for the stresses due to inertia. To show this allowance, points were plotted having corresponding values of b and h for the co-ordinates. This curve shows that h is from 2.18 to 4 times b; the mean value being 2.73 b.

Main Journals.—The diameter of the crank shaft at the main journals has already been discussed.

The length of journal to prevent undue heating was examined upon the basis of the formula: $l = C \frac{HP.}{L}$, but the data are insufficient (with the varied proportions of the different builders) to clearly locate the general direction and position of the mean line.

For projected area of each main bearing, the formula is: $d l = C' S A = C A$ (taking a standard steam pressure).

The examination gives values of C ranging from 0.367 to 0.739, the mean value being 0.489.

If p is the pressure per square inch of projected area, $2 p d l = S A$; hence $\frac{2 p d l}{S} = \frac{d l}{C}$; or $p = \frac{S}{2 C}$.

With steam pressure of 100 lbs. per sq. in. this gives about 100 lbs. as the pressure per sq. in. of projected area, using the mean value of C, while the minimum and maximum values of C give about 140 and 70 as the extreme values of p.

Crank Pin.—The length of crank pin, l, was investigated upon the basis of the formula, $l = C \frac{HP.}{L}$, plotting l as ordinates and $\frac{HP.}{L}$ as abscissas. As in the similar case for main bearings, the points located were very irregular.

The equations derived from these lines are, respectively

$$l = 0.333 \left(\frac{HP.}{L}\right) + 2.2 \text{ ins.},$$

$$l = 1.192 \left(\frac{HP.}{L}\right) + 0.88 \text{ in., and}$$

$$= 0.417 \left(\frac{HP.}{L}\right) + 3.92 \text{ ins.}$$

These expressions do not accord in form with the fundamental formula, and it is evident that more data should be obtained before trying to establish formulas for this case.

The projected areas of the crank pins were found to be represented by the expressions: $d l = 0.22 A$ for the mean, 0.07 A for the minimum, 0.44 A for the maximum. These values give pressures per square inch of projected area (for steam pressure of 100 lbs. per sq. in. of piston), as about 450, 1,400, and 225, mean, maximum, and minimum, respectively.

Face of Piston.—As would be expected, a wide divergence was noted in the ratio of diameter to face of piston. The following formulas were obtained: Face = 0.437 D for the mean, 0.300 D for the minimum, 0.650 D for the maximum.

Crosshead Pin.—Projected area of crosshead pin varies from 0.066 A to 0.346 A; the mean value, as observed, being about $d l = 0.105 A$.

The length of crosshead pin was found to vary from d to 2 d; the mean being $l = 1.33 d$.

Flywheel.—The weight of rim, W, should be proportional to $\frac{HP.}{D_1^2, N^2}$ (in which D_1 is diameter of wheel in inches), for engines on similar service, steam distribution, etc. A wide range of weights is to be looked for here, and this expectation is justified by the examination. The values of C in the expression $W = C \frac{HP.}{D^2 N^2}$ are 833,000,000,000 for the mean, 341,000,000,000 for the minimum, and 2,780,000,000,000 for the maximum.

As in the other cases, the general practice lies comparatively close to the mean; the extreme values of the constants covering the widest range observed, which is approached by but few of the engines examined.

The linear velocity of rims of wheels was treated thus: The average velocity of each maker was found, then the mean of these averages was determined. This general mean is about 4,200 ft. per minute.

Weight of Reciprocating Parts.—For engines having similar compression, smoothness of running (in passing the dead-points) indicates that the weight of reciprocating parts, W, should be proportional to $\frac{D^3}{L N^2}$. Taking the reciprocating parts as made up of the piston, piston rod, crosshead, and one-half the connecting rod, a diagram was obtained by plotting the weight of these parts as abscissas, and the corresponding values of $\frac{L N^2}{D^3}$ as ordinates. By using the reciprocal of $\frac{D^3}{L N^2}$ for y, the mean curve takes the form of the equilateral hyperbola, $xy = C$, and the value of C is found to be 1,850,000; hence

$$W = 1{,}850{,}000 \frac{D^3}{L N^2}.$$

Weight of Entire Engine per HP.—It is probable that some of the engine weights, as furnished, are not very exact; but the data given show that the average weight of engine, W, among the engines examined, is W = 117 (HP. — 7), or W = 117 (HP.) — 820 lbs.

* Abstract of a paper presented at the New York meeting of the American Society of Mechanical Engineers.

** Associate Professor of Machine Design, Sibley College, Cornell University.

IMPROVEMENTS IN THE NIAGARA WATER METER.

The ever-busy water-works superintendent hails with delight each improvement in water-works appliances which will save him and his men time and labor without detracting from the efficiency or economy of his works. An improvement in the Niagara water meter, designed with this end in view, is shown by Fig. 1. It consists of the use of a square-flanged case, requiring only four bolts, instead of the eight or more previously employed in

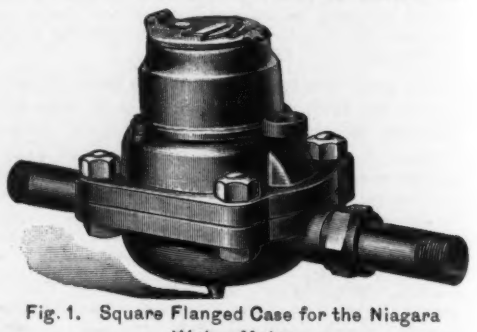


Fig. 1. Square Flanged Case for the Niagara Water Meter.

the round-flanged cases made by the same company. In addition, it is claimed that this shape is more compact and more accessible for cleaning than the round style. Of course, the weight of the case is somewhat increased by using this form, but no extra charge is made for it. The manufacturers, the Buffalo Meter Co., of 363 Washington St., Buffalo, N. Y., state that there is no difficulty in making these joints tight for 300 lbs. pressure.

Another improvement in the same meter is shown

Fig 2. Corrugated Metal Disk for the Niagara Water Meter.

by Fig. 2. This is the introduction of corrugations in the hitherto flat side of the web of metal-measuring disks or pistons. The flat webs have answered well when made of hard rubber, which is, of course, light and elastic, but suitable for cold water only. The new disk is designed especially for use in an all-metal meter for oil or hot water. It is made of gun metal, with a hollow ball, and is said to be both light and sensitive. It is claimed for the corrugations that they form a water-packing between the web and the end walls of the disk chamber, and render the meter less liable to obstructions from sand or sediment.

Both of the improvements described above were originated by Mr. Geo. B. Bassett, M. Am. Soc. C. E., of Buffalo.

THE WATERLOO & CITY UNDERGROUND RAILWAY, LONDON.

The construction of the tunnels for the new electric underground railway to connect the busy center of London with the Waterloo terminus of the London & Southwestern Ry., on the south side of the Thames, is progressing steadily.

The total length of the road will be 1½ miles, and the time of transit will be about four minutes. There will be two single-track tunnels, with terminal stations only. At the Waterloo end, the rails will be 36 ft. below the rails of the London & Southwestern Ry., and at the London terminus they will be 65 ft. below the street surface, hydraulic elevators being here used. The steepest grades are 3.3% with the load and 1.66% against the load. The engineers are Mr. Greathead and Mr. Galbraith; and Mr. H. H. Dalrymple Hay is Resident Engineer. John Mowlem & Co. are the contractors.

The work of tunneling was commenced at a point in the river near the south shore, where a stage was erected on piling, and from it were sunk two iron caissons to a depth of 13 ft. in the clay. The shafts were then excavated to the proper depth and lined with brick. The tunnels were started, work being carried on in both directions, by the shield system, and at the present time a considerable length has been excavated in each direction. The cast iron lining tube is built up of sections 20 ins. wide, consisting of seven segments and a keypiece at the top. The internal diameter is 12 ft. 1¾ ins., except at several points where sharp curves necessitate a diameter of 12 ft. 9 ins. A considerable amount of water is being encountered in certain portions of the work, and there excavation is done under pneumatic pressure, an air lock following the shield.

The electrical installment in this tunneling plant is so unique in many respects as to deserve more than passing notice. In the tunnels is laid a narrow-gage railway, on which electric locomotives of special design haul the loaded and empty cars to and from the bottom of the vertical shaft. The generating plant, elevator machinery, etc., are situated at the top of the shaft. The loaded cars are raised, and their contents dumped directly upon barges waiting in the river. In this way a very convenient means of transportation, both to and from the works, has been provided, all construction material being delivered by the cheap water route. Three electric locomotives, whose operation has been very satisfactory, were manufactured by Siemens Bros. & Co., and from photographs and the description before us, they seem well adapted to the special conditions under which they are operated. They were built extremely narrow, to permit of the necessary sidings at certain points in the tunnel. Especial attention was paid to the protection of the motor parts from dampness. An overhead trolley connection and current at 200 volts are used. The return circuit is through the rails, which are not bonded, but are connected at intervals to the iron lining of the tunnel. The Greathead shield is pushed forward by eight compressed air-jacks, placed at points around its circumference, and backed against the flange of the iron ring already in position. The compressed air for these jacks and for the air-lock is furnished by three-throw pumps driven through worm-gearing by electric motors on the 200-volt circuit. The lighting of the tunnel is, of course, by incandescent lamps, a separate 100-volt circuit being provided for that purpose. Lastly, a complete telephone system is in operation, with an exchange at the foot of the vertical shaft, by which the engine room and offices may be connected with the ends of the tunnels. It is expected that the line will be opened to the public in the latter part of 1896.

A RIDE ON THE READING SINGLE-DRIVER EXPRESS LOCOMOTIVE.

A decided novelty in American express locomotives which has been brought out this year is an engine with a single pair of driving wheels, and the results obtained during a regular service of about five months appear to indicate that this is likely to be the commencement of a new standard type of express engine. The engine was described and illustrated in our issue of Aug. 29, 1895, but it may be briefly noted here that it is a Vauclain four-cylinder compound engine, with Wootten firebox. The cylinders are 13 × 26 ins. and 22 × 26 ins., driving a single pair of 7-ft. wheels, while under the front end is a four-wheel truck with 36-in. wheels, and under the firebox is a single pair of 54-in. wheels, whose boxes are carried in pedestals on the main frame. The total weight is 115,000 lbs., of which 48,000 lbs. are on the driving wheels and 39,000 lbs. on the truck. The boiler pressure is 190 lbs.

The reasons for designing the single-driver engine were as follows: It appeared that the four-coupled locomotives were able to haul from 10 to 12 cars at a speed of 60 miles per hour, and 14 to 17 cars at a speed of 56 miles per hour. As the adhesion of the four-coupled engine is about 83,000 lbs., and as the usual express train service between New York and Philadelphia requires trains of but five or six cars, it is obvious that a locomotive having so great an adhesion is unnecessary; in fact, half the adhesion of the four-coupled engine is abundant. To test this view, locomotive No. 618, of the Columbia type (Eng. News, Dec. 5, 1895), was changed to a single driver engine by removing the side rods and recounterbalancing the wheels. Thus altered it ran throughout the winter of 1894-95 and the spring of 1895, showing as creditable a performance in regularity and speed as any other locomotive in the service. It was therefore determined to construct a single-driver locomotive, designed to obtain the best results as such, the advantages expected being a smooth riding machine, less internal friction, less weight of locomotive, omission of side rods, and reduced counterbalance weights, with consequent less disturbing effects upon the track, the whole resulting in great economy of operation. The builders express themselves as satisfied that all of these advantages have been gained in engine No. 385.

This engine, which was built by the Baldwin Locomotive Works for the Philadelphia & Reading R. R., has now been in service since July 4, making a round trip daily from Philadelphia to Jersey City (for New York) and back. The tires are in good condition, and the only sign of wear is in the guides, which need a little taking up. The average load is five cars, of which two or three are Pullman sleeping cars, and the others, heavy day cars of the "Blue Line" expresses. As a maximum load, it has hauled nine cars, of which six were Pullman cars, making its regular schedule, and even making up time lost by stops. In addition to the stops, there are regular slowdowns at the Yardley trestle (with track tanks on the trestle), and at the drawbridge on the Newark Bay trestle, while the train has also to slow down now through Elizabeth, on account of the work of separating the grades of the railway and streets, and is always liable to be checked by signals between Elizabeth and Jersey City, where the traffic is heavy. A profile of the line was given in our issue of Aug. 29, and the schedule is as follows, including all stops and slowdowns:

Northbound.

	Time, a. m.	Miles.	Av. speed, miles per hr.
Leave Philadelphia	7:30	...	...
" Spring Garden St.	7:32	...	...
" Columbia Ave.	7:36	1.8	18.0
" Wayne Junction	7:42	8.3	33.3
" Jenkintown	7:50	5.8	43.5
" Trenton Junction	8:13	22.0	60.0
Arrive Jersey City	9:18	57.3	53.0
Total	1 hr. 48 m.	90.2	50.0

Southbound.

	Time, p. m.	Miles.	Av. speed, miles per hr.
Leave Jersey City	4:12	...	..
" Elizabeth*	....	..	..
" Wayne Junction	5:47	85.1	54
" Columbia Ave.	5:54	3.3	30
" Spring Garden St.	5:58	...	..
Arrive Philadelphia (Reading Terminal)	6:00	1.8	18
Total	1 hr. 48 m.	90.2	50

* Stop on signal, usually made.

A trip from Philadelphia to Jersey City on this engine was recently made by a member of the staff of this journal, the train being the 7:30 a. m. from Philadelphia. The train consisted of three day cars and two Pullman sleeping cars, and the engine took out all the slack in the couplings as soon as it was attached to the train, so that it had to start with a dead pull on the entire train, which it did, however, with very little slipping, using no more sand than would have been used for an engine with four driving wheels. The morning was damp and there was a light drizzling rain, so that the rails were in bad condition for a single-driver engine, yet slipping occurred very rarely, and only when running slowly. The train was raised to speed very quickly after each stop, and with apparently as much ease as an eight-wheel engine would have done it. Buckwheat coal is commonly used (and is cordially disliked by the men), but on this occasion egg coal had been obtained, as there was no buckwheat on hand, a fact upon which the engineman and fireman congratulated themselves. As on most of the engines with Wootten fireboxes, the fireman has an assistant to attend to the two firedoors, and so prevent the loss of steam pressure, which would result from keeping the doors open while the fireman is filling his shovel. The steam pressure averaged about 180 lbs., and only rarely got as low as 160 lbs. No log was kept of the run, but several consecutive miles were run at 55 and 50 seconds to the mile, or at the rates of 65.45 and 72 miles per hour. The highest speed noted was a mile in 48 seconds, or at the rate of 75 miles per hour.

One of the notable features was the remarkably easy riding of the engine and the freedom from jarring and jerking, the engine appearing to have a motion peculiar to itself, which upset previous ideas of judging the speed by the "feel" of the engine. Thus, when the motion led the writer to estimate not less than 70 seconds to the mile (judging from the experience with the motion of coupled engines), the watch showed that it was really about 50 seconds to the mile.

The return trip from Jersey City was made on No. 386, of the Central Railroad of New Jersey, a Vauclain four-cylinder compound of the eight wheel type, with ordinary firebox. This engine, illustrated in our issue of Dec. 8, 1892, has cylinders 13 × 24 ins. and 22 × 24 ins., and driving wheels 6 ft. 6 ins. diameter, the total weight being 123,800 lbs., of which 88,400 lbs. are on the four driving wheels. The train was made up of six cars, including through sleeping cars for the Baltimore & Ohio Southwestern R. R. This train makes the run of about 91 miles (to the B. & O. R. R. station at 24th and Chestnut Sts., Philadelphia) in 2 h. 4 min. (10:12 a. m. to 12:16 p. m.), including one regular stop at Wayne Junction (and two stops on signal), the average speed from start to finish being 45 miles per hour. This engine, although it hauls the train very steadily, rides very hard, with a harsh, jarring motion that is decidedly unpleasant, and which is apparently due to an excess of weight in counterbalancing the reciprocating parts.

It should be noted that on this route there is an excellent road all the way from the Philadelphia terminus to Jersey City, the track consisting of heavy rails spiked to good, wide ties laid in stone ballast, and the curves being well set up for fast running. The excellence of this track might, perhaps, not have been fully appreciated but for the fact that on the return trip the train did not follow the main track from Wayne Junction to the P. & R. R. R. terminal station, but followed the line to the B. & O. R. R. station at 24th and Chestnut Sts. The lurching and rolling of the engine on this piece of track was most marked after the steadiness on the rest of the ride. There are Hall automatic signals from Philadelphia to Jenkintown, and Westinghouse pneumatic signals from Bound Brook to Jersey City (Eng. News, April 4, 1895, and March 29, 1890).

A test of mechanical filters is proposed in connection with the water-works of Minneapolis. Mr. F. W. Cappelen, City Engineer, is reported as having been in correspondence with manufacturers of these filters, with a view of having 250,000-gallon plants of the various systems set up for an experimental test of six months' duration, without further expense to the city than the furnishing of power to such plants as require it.

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In an address recently delivered before the students of Lehigh University, President Thos. M. Drown took as his subject the "Educational Value of Engineering Studies." He referred to the experimental work and original investigation which find a place in our best engineering schools, as, in reality, the most valuable training received by the student; as being of the highest educational value and making our technical schools grand training schools of mental development. The habit of logical, accurate and precise thinking is the object aimed at by the successful teacher in technical schools, and this habit is of more permanent value to the graduate, when his efforts are well directed, than are all his store of mere facts. President Drown then said that while the education of the engineering student was, in many respects, more thorough and more generally useful than the education afforded by the study of the classics in the colleges, it lacked the mellowing and beautifying elements which a little of the humanities would introduce. If the young man can afford to make engineering a graduate study after a college preparation, it would be well; but few can afford the expenditure of time and money involved. President Drown assumes a knowledge of modern languages as belonging to the professional course of the engineer, but he would continue the study of the English language and literature until the senior year in every engineering school, and if the technical studies demand the full four years usually assigned them, he would add another year to the course.

There is wisdom and food for profitable thought on the part of both educators and engineering students in this advice of President Drown. A successful engineer is not merely a designer and builder and an expert in figures and formulas, he must also be a man of affairs, keen and quick of perception, and able to talk well and to write well upon all matters pertaining to his profession. The practical technical training he receives at his engineering school is intended to develop logical, accurate and precise thinking; but the clear expression of this thought in good, forcible English is every bit as important. Ability in this direction, is, in fact, one of the tools of his trade, as President Drown says, and he is continually called upon to use this ability in writing reports, specifications and other engineering documents, the value of which, to the engineer and to his clients, depends largely upon their clearness, fullness and accuracy. Bungling, misleading specifications and obscure reports are, unfortunately, too common, and the inability on the part of many engineers to say plainly what they have to say, is particularly evident to the publishers of technical journals. To the lack of this element in the training of engineers can be traced the beginning of costly lawsuits and the failure of many otherwise worthy schemes; failing because they are improperly or inadequately presented to those who depend upon the engineer for guidance in the project involved. To the engineer educated both technically and in the "humanities," the door of preferment is more widely opened than if he had the most expert knowledge of engineering methods, but is uncultivated in the sense here implied. In fact, cases are not uncommon where the man who can talk and write well upon engineering topics outstrips those who are better equipped than he is in technical training and the broad knowledge of engineering practice. How this culture study can be united with professional studies, without detriment to both, is a question which must be left for solution to the educators themselves. But with the present development in the methods of training students, and in the great advance already made upon the educational practice of only a few years ago, it should not be difficult to devise some means of introducing enough literary studies into a professional course to mold the mind of the young engineer when it is yet plastic, and to implant in him a desire to continue these studies as future opportunity occurs.

Previous to 1889 the city of London was ruled, so far as its municipal works were concerned, by the vestries, conducted as close corporations, and by the equally close Metropolitan Board of Works. London was not included in the municipal legislation of 1835, which has satisfactorily settled the question of city control in Liverpool, Birmingham, Manchester and other large English cities. But in the year named a change was made, and the first London County Council was elected by popular vote; any householder whose name was on the registry was entitled to vote, though he only rented a garret room in a tenement; and widows and unmarried women owning or renting the rooms they lived in were equally entitled to this vote. The result of this first election was the selection of a municipal parliament of thoroughly representative and able men; all action was public and many schemes for reform were broached and actively pushed. But when the second council was elected, in 1892, politics were introduced and party lines were closely drawn, with the result that the cliques were about equally divided and each practically blocked the proposed reforms of the other. In the election just held the Progressive faction has been defeated by the Moderates, and as the successful party seems to have no programme of its own, the outlook for the promised improvement in the control of London's municipal affairs is not encouraging. The Progressive plan proposed the municipal control of water and gas works, of electric lighting, docks, water fronts, markets, street railways, burial grounds, and charities. It advocated the control of the police by the Council; it wished to abolish the corporation of the Old City with its ancient traditions and privileges, and along with it the exclusive privileges of the liveried companies. It advocated an equalization of tax rates and assessments and a readjustment of financial burdens on equitable principles. These revolutionary propositions arrayed against the Progressives all the powerful corporations, whose long-enjoyed privileges were threatened, and at the same time frightened the more timid electors, and to this the Progressives' defeat is ascribed. As a consequence, after all the bright promises held out by the change of rules and system, conservative Old London seems to have asserted itself, for the time, and stands by its traditions and old practices, with all their faults. It is an interesting exhibit of the power of the vested rights which it was the purpose of the framers of the new law to curtail, at least, if not abolish; and it will be still more interesting to see how much longer they can successfully withstand the progressive movement which now pervades all England, and controls the cities outside of London. Fortunately, in our own proposition for a Greater New York this particular element of vested rights is not a factor in the general control. But party issues vs. what is for the best interest of citizens has power here as well as in London to block projected improvements; so that in the final result the present experience of Londoners is not peculiar, and it may be instructive to watch further developments in the English metropolis.

Makers and users of steam boilers and engineers generally will be interested in the account on another page of the trial of the suit of the Philadelphia Edison Electric Light Co. against the makers of the Root water-tube boiler for damages alleged to have been caused by the defective construction of the boiler. A number of technical points were involved in the case which are of great interest, such as the breakage straight across without reduction of area at the point of fracture of bolts of exceptionally ductile material, the action of caustic soda and of catechu in combination with bad feed water, apparently causing leaky joints, and forming incrustations upon the outside of a boiler, and finally the occurrence of water-hammer in a boiler of the inclined water-tube type. As far as our knowledge goes, no similar instance of water-hammer being produced in a boiler having inclined water tubes has ever been known, but neither do we know of any experiments having been made hitherto to show what would happen if such a boiler were driven with a forced blast of a pressure equal to 4 ins. water column.

Briefly stated, the facts of the case were that some bolts holding the connecting bends of the Root boilers broke, causing loss of life and damages to the Electric Light Co. The latter company claimed that the ruptures were due to bad material, bad workmanship and faulty design. The makers of the boiler claimed that they were due to over-driving, bad feed water and general bad treatment of the boilers. The jury took the latter view, and found a verdict for the Abendroth & Root Mfg. Co.

According to the testimony of the Electric Light Co., it was damaged $34,000 by the ruptures. It is now about four years since the fatal accident happened, and while the Abendroth & Root Co. were, according to the verdict of the jury, entirely innocent of all wrong-doing, they must have sustained a serious loss in business, especially for a short time following the accident, due to the charges widely published in trade and other newspapers, and circulated by salesmen of rival boiler companies, that it was the bad construction of the boiler that caused the accident. For this kind of damage there seems to be no remedy; it is one of the risks a boiler-maker must assume when he makes a contract. He can neither compel his customer to use and care for the boiler properly, nor can he prevent the circulation of injurious reports when an accident takes place.

DANGER IN CAST IRON STEAM-PIPE ELBOWS.

Two explosions of cast iron steam-pipe elbows have recently taken place in New York city, as recorded in our issues of Nov. 21 and 28. In the first of these, $3,000 worth of belting was ruined by the escaping steam, and in the second two men were fatally injured. In the latter case the coroner's jury has found that the men came to their death "by the bursting of an elbow in the supply pipe of an engine, due to causes unknown to the jury," and recommends that "in future all steam-pipes should be tested at the same time boilers connected with them are tested." Whether anything will be done in regard to this recommendation by the authorities remains to be seen; but it is difficult to see how any test of a steam-pipe made at the same time the boilers are tested could reveal whether or not a cast iron elbow was safe against the strains caused by "water-hammer" or by repeated expansion and contraction of the pipe. Almost any cast iron elbow is strong enough to resist an internal pressure several times as great as the working pressure allowed upon it, and the ordinary cold-water test, in which

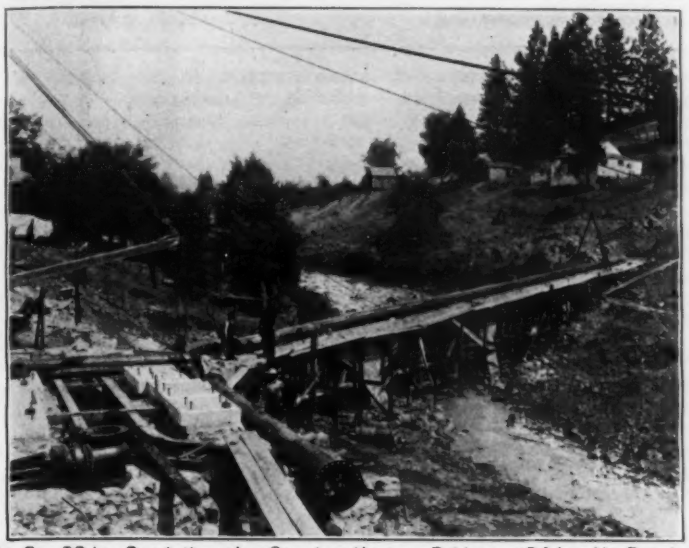

Fig. 2. 20-in. Conduit under Construction on Bridge. (24-in. Air Receiver beside Foundations for Air Compressors and Pelton Wheel).

Fig. 3. Conduit on Bridge Covered with Masonry. (Air Chambers in Position and Charging Tube, Relief Valve, and Air Valve on Receiver in Place. Compressors and Wheel being put in).

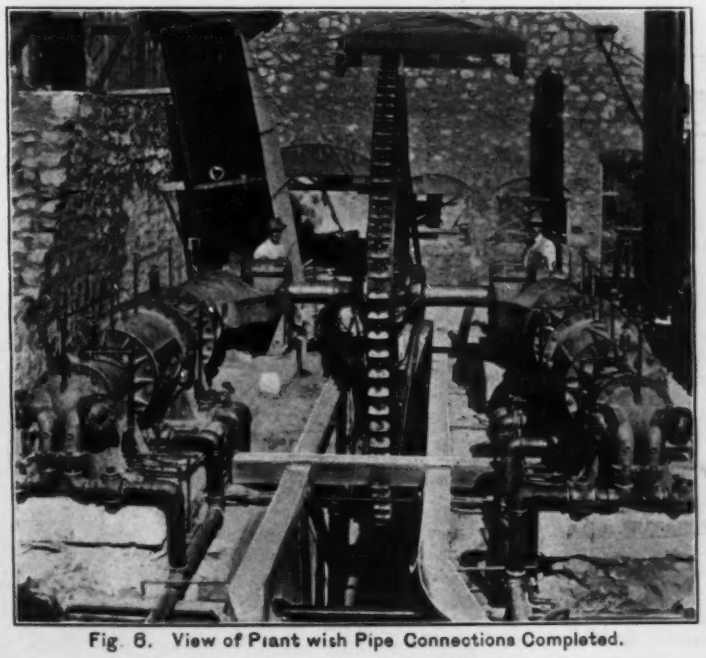

Fig. 6. View of Plant with Pipe Connections Completed.

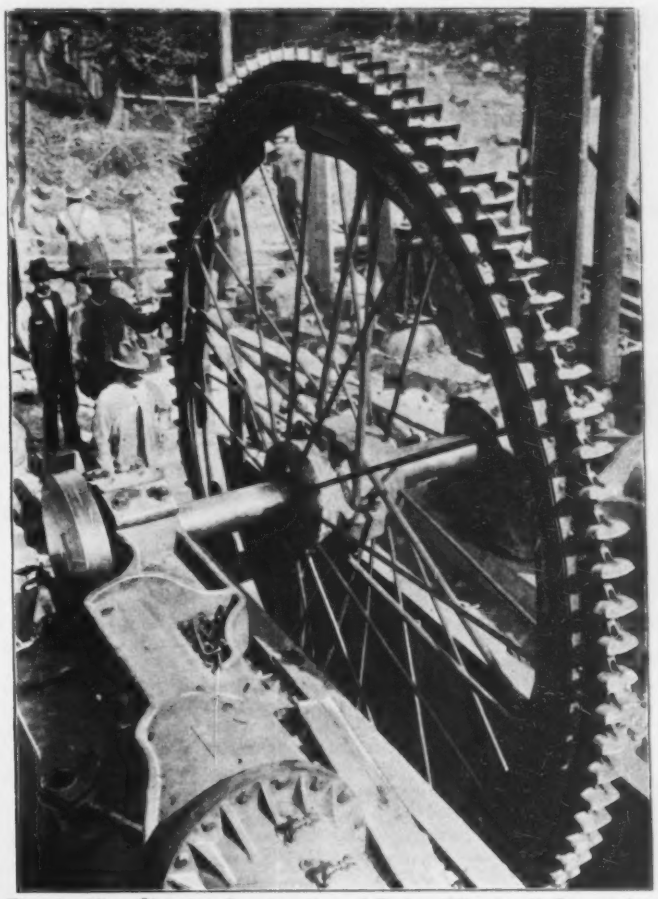

Fig. 4. View Showing Construction of Pelton Wheel with Suspension and Tangential Spokes.

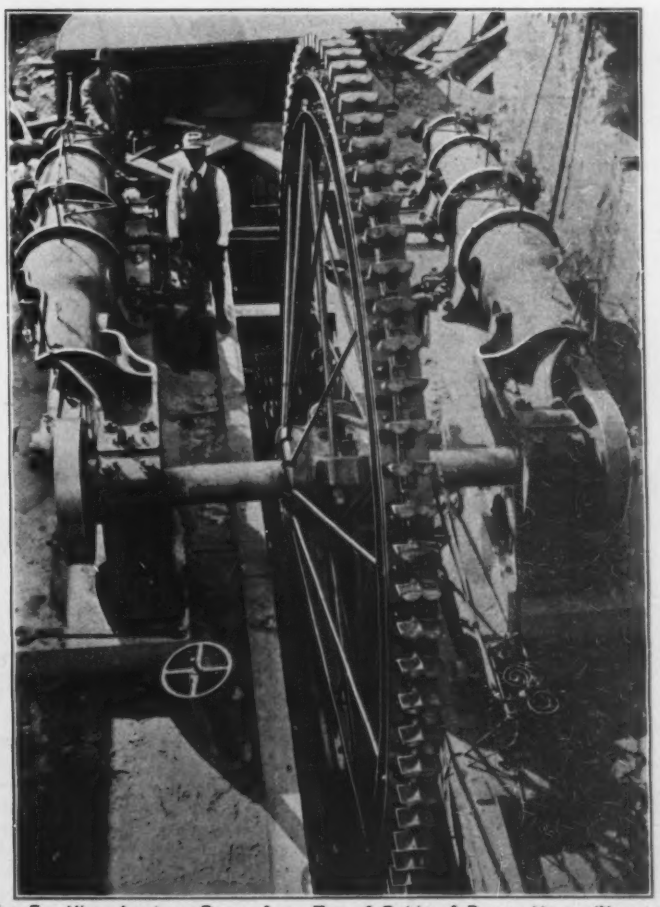

Fig. 5. View Looking Down from Top of Gable of Power House Showing Intercooler in Wheel Pit and Governor.

Water Power Air Compressor Plant of the North Star Mining Co., Grass Valley, Cal.

Arthur De Wint Foote, M. Am. Soc. C. E., Chief Engineer.

The Pelton Water Wheel Co. and the Fulton Engineering and Shipbuilding Works, San Francisco, Contractors.

a pressure 50% greater than the working pressure is used would not be likely to reveal any hidden flaw in the iron. No practicable test could be made which would imitate the strains caused by water-hammer or by expansion. Testing of steam pipes or of elbows for their resistance to static pressures should be carried out at the works where they are made, as is the universal custom in the manufacture of welded iron or steel pipe, when it is necessary to determine whether or not a weld is properly made, and the pressures used are, or should be, far greater than any which would be applied in the hydrostatic tests of boilers.

The precautions which should be taken in the case of cast iron elbows to insure against such explosions as those that have recently taken place are: (1) No cast iron elbow should be used which has not been tested, at the place where manufactured, by a pressure several times as great as the working pressure to which it is to be subjected; (2) lines of steam piping should be so designed that there can be no "pocketing" of water from condensation or from priming which can give rise to a water-hammer, and so that the elbows will be free to move with the expansion and contraction of the pipe without having bending strains brought upon them; (3) before being used the lines of piping should be inspected by the boiler inspector, building inspector or other official charged with similar duties; (4) engine drivers should be instructed never to open a steam stop valve leading to an engine or to a long line of pipe without first draining the pipe on both sides of the valve from water which may have collected in the "dead ends," and always to admit steam to a cold pipe very slowly A still better precaution against the explosion of cast iron elbows is to do away with them entirely, and use steel castings instead. With a view to learning how extensively steel castings have been used for steam pipe elbows, we have applied to several steam casting companies for information, and from the replies we learn that their use for high pressures is now quite common. The Roberts high-pressure water tube boiler, used largely on steam yachts, has been made with steel casting elbows, tees and return bends for a number of years. Refrigerating machine builders long ago abandoned cast iron for fittings. The American Steel Casting Co., of Thurlow, Pa., which is a consolidation of several concerns formerly running separate works at Thurlow, Sharon and Norristown, Pa., Syracuse, N. Y., and Alliance, O., informs us that they have for some time been producing steam elbows, tees, etc., from cast steel with most gratifying results. The steel used for the purpose has a tensile strength of 60,000 to 65,000 lbs. per sq. in., and an elongation of 20 to 25% in 2 ins. As the strength is three to five times the strength of cast iron, and the ductility many times greater, there would seem to be no reason, except that of cost, for not abandoning cast iron steam-pipe elbows entirely and substituting steel castings.

PROPORTIONS OF HIGH-SPEED STEAM ENGINES.

Of the several excellent papers presented at the New York meeting of the American Society of Mechanical Engineers, perhaps none is likely to have such an influence on actual practice as the one by Professor Barr, on the "Proportions of High-Speed Engines," an abstract of which we give in this issue. The building of automatic high-speed engines has had a wonderfully rapid development during the past 15 years, and they have thus far had neither the time to grow into an approximation to a standard form such as the Corliss engine has had for many years, nor the expenditure of brainwork in designing their proportions which has been given to the marine engines. The designing of these engines seems to have been done on the principle of "every man for himself," and the result is the extraordinary variety of proportions which is brought to light by Professor Barr's paper. Why one builder should use the same diameter of a crank-shaft for 300 HP. that another does for 100 HP.; why one should use a projected area of crank-pin six times as great as another uses on the same size of engine, or why one should use a flywheel eight times as heavy as another, can only be explained by the supposition that some builders do not know how to design engines. They have not even the time-honored reason of "practical experience" as an excuse for their proportions, for the short time that automatic high-speed engines have been on the market is not long enough for any one to have developed such a system of designing as will place enough weight of metal and sufficient area of bearing surfaces just where they belong without unnecessary excess or extravagance. The experience of the world has not yet determined, for instance, how far a band wheel weighing a ton, and carrying a tight belt running a mile a minute, may be overhung beyond the shaft bearing, without danger of springing and finally breaking the shaft, or what diameter the shaft should be to resist the unknown strains under such conditions. We heard recently of an engine builder who all at once changed the diameter of the shaft of a particular size of engine from 5 ins. to 8 ins. As the strength of a shaft to resist torsion varies as the cube of its diameter, the second was stronger than the first, in torsion, in the ratio of 512 to 125, or over 4 to 1, or if bending is the strain to be considered, the strength varies as the square, and the second shaft is stronger than the first in the ratio of over 2½ to 1.

The engine builders are not altogether to be blamed for the fact that they do not yet know the proper proportions to be given to the parts of high-speed engines. There are four different systems upon which proportioning may be based—viz., 1, guesswork; 2, copying; 3, experience; 4, theory. No theory has yet been laid down by any writer upon which all the details of a high-speed engine can be based, nor can any theory be devised until there are more facts upon which to base a theory than we now possess. If any one doubts this, let him try to determine theoretically the diameter to give the shaft of an overhung band wheel, such as we have already mentioned, with a tight belt run at a high speed. Practical experience, as before stated, is not yet extensive enough to have developed a standard set of designs. Copying will give a good design only when the original is good. Thus we are forced back to the first principle of original design of high-speed engines, or guesswork. This was undoubtedly the system adopted by the first builders of these engines, before copying became practicable, and engine builders were not to be blamed for adopting it. The first designs were found, on trial, to be too weak in one detail or another, then that detail would be strengthened, more or less, also by guesswork. Some designers were bold and generous; others were narrow and stingy; the first would be apt to make a detail far stronger or larger than was necessary, and would not discover that they had wasted material, while the second, by having their engines broken now and then, would gradually strengthen their engines till they would not break, but having no theory and insufficient practice, they might also make certain details far too large. In the course of time these two classes of designers would come closer together in their practice, the narrow ones by the method of strengthening one detail at a time, the bold ones by competition forcing them to attempt to avoid waste, but this process is an exceedingly slow one.

Professor Barr now comes along with his investigation of actual designs, and furnishes a method by which the time of rational and correct designing may be hastened. He collates and compares what has been done by a great number of builders, puts the results into the shape of rational formulas, with empirical coefficients, and reveals for the first time the extreme diversity of these coefficients. Each builder can now compare his own proportions with the average, maximum and minimum proportions shown by Professor Barr. If he discovers that his proportion of any detail is about the maximum, he will consider whether it would be good economy to reduce it. If he finds his proportion is the minimum, he may be led to increase it if he finds that that detail has ever given any trouble. So there ought to be in future a gradual approach to uniform proportioning. If Professor Barr should repeat his work 10 years hence, we have no doubt that he will not then find any such extreme diversity in sizes of parts as he now finds, and that there will be a closer grouping of the sizes of different builders about an average than now appears. The result will be economy to the builder in his avoiding useless surplus of material and economy to the user in less frequent stoppage for repairs.

One especially gratifying feature of Professor Barr's investigation is the fact that the builders of engines have been so ready to furnish him with drawings and with particulars of sizes of their engines. It is a sign that the old fetish of secrecy about all work-shop operations is rapidly disappearing. The intelligent manufacturer now knows not only that it is practically impossible to keep from his competitors the knowledge of what he is doing, but that if he attempts to do so he shuts himself in from the opportunity to learn what is being done outside of his own shop. The most exclusive shops are invariably the least progressive and the most apt to be the first to fall behind in competition. We have no doubt that the engine builders who furnished information to Professor Barr, which others might have kept secret, are the most enterprising and successful builders in the country, and that their courtesy will be repaid to them many times over.

The absurdity of the still too prevalent custom of considering shop drawings as sacred is admirably shown by Professor Barr's paper. Probably most of these manufacturers would have held up their hands in horror if it had been suggested to them that they permit drawings of their engines, with full dimensions, to be published. The idea has still a strong hold that there is some peculiar value about the dimensions and proportions which working drawings disclose. This idea is based on the supposition that some one is ready to copy all such dimensions if they are once made public. Professor Barr's paper shows how little any engine builder would be likely to gain by any such mere copying. He would be quite as likely to injure his machine as to improve it.

LETTERS TO THE EDITOR.

ANGLE-STIFFENERS ON PLATE GIRDER CHORDS.

Sir: Referring to recent correspondence in your columns on railway plate girder bridges with stiffened top flanges mentioned as "novel," the writer recollects C. Shaler Smith, C. E., building these as early as 1880, on the Chicago, Milwaukee & St. Paul Ry. The top flange of 76-ft. three-track through girder was made up of two angles, one channel with inverted flanges and additional flange plates as in the ordinary plate girder. The flanges of these channels were designed to answer the purpose of a guard rail on same narrow through girders, although for an ordinary railway girder, the writer can see no occasion to stiffen. Yours truly,

C. L. Gates,
Engineer Toledo Bridge Co.

Toledo, Ohio, Dec. 7, 1895.

THE FRANCHISE FOR THE BUFFALO TRACTION CO.

Sir: I am very much surprised to read in the Engineering News of Dec. 12 that "the Board of Aldermen of the city of Buffalo has recently voted to give away a franchise to a new street railway company." At a meeting of the Board of Aldermen, a resolution was passed in which it was declared as the sense of that Board that they would grant a franchise to the Buffalo Traction Co., after the Board, together with the Corporation Counsel, had agreed upon conditions which should be imposed upon the Traction Co. The whole matter was then referred to the Street Committee and the Corporation Counsel to draft conditions, they to report to the Board at a specified time. The Traction Co., through its proper representatives, has signified its willingness to submit to all reasonable conditions.

The Railroad Commissioners of the state are now considering the application of this company for a charter, and the hearing before the Commission will be resumed in Buffalo next week. The only opposition which has thus far appeared comes from the only street railway company now operating in Buffalo, and from a few property owners on some of the residence streets. Such a very large majority of the people of the city of Buffalo are in favor of the entrance of this new company that it would have been manifestly improper and unwise for the Aldermen to have taken any other action, and you can readily see that this must have been so from the fact that the vote of the Board was unanimous.

I hope that you will make a correction of the mis-

statements contained in your editorial, which I am very sure must have been based upon insufficient data. I am, Yours very truly,,

Geo. A. Ricker, Chief Engineer.

Buffalo, N. Y., Dec. 12, 1895.

(We cheerfully give space to the above letter and are glad to learn that some conditions are likely to accompany the granting of the franchise to the Buffalo Traction Co. Our note was based on information that the grant of the franchise by the aldermen was a final action. On the other hand, we must frankly say that the course pursued in this case seems to us a mistaken one, and not for the best interests of the city of Buffalo. It may be safely laid down as a general principle, that it is for the best interests of a city that all its street railway lines should be operated by a single corporation. The street railways of a city should be planned to make a single symmetrical system, so as to give all its sections the best accommodations with the least mileage of road and smallest operating expense. This can be only approximately attained when two or three different companies must all have facilities to reach the business center, and to a greater or less extent parallel each other and furnish duplicate service. As a matter of fact, where two competing companies are given access to the streets of a city, experience shows that their consolidation is only a matter of time and generally of a short time. In view of this fact, and of the other well-known fact, that corporations have no souls, it is a mistake for cities to grant favors or withhold them on the ground that a given corporation is either good or bad. In the present case, it would seem to be a mistake for the Buffalo authorities, in response to a heedless popular clamor, to shut out the existing Buffalo street railway company from consideration in granting the franchise for new lines, provided it is willing to offer terms as favorable or better than the newcomer. The city has something of value to dispose of, and ought to get the best price possible. Yet, those in charge of its affairs shut off competition at the outset by announcing that they would dispose of this right to a certain company, on terms to be agreed upon. If we may judge the temper of the two companies at the present time by the newspaper reports of the proceedings before the aldermen, Buffalo has now an opportunity to place its street railway franchises on a proper basis. The outcome of the negotiations with the new company will be awaited with interest.—Ed.)

MOMENTS OF STRESSES IN SWING SPANS WITH FOUR SUPPORTS.

Sir: Replying to Mr. Schaub's answer to my criticism of his article in "Modern Framed Structures" in your issue of Oct. 24, I would say that I cannot but take issue with him when he says that the theorem of three moments is applicable to the form of truss under discussion. Some of its principles may be, but the fact that it is partially hinged at two supports violates one of the principal conditions of the theorem. The actual conditions of the problem must be considered in detail in order to arrive at a satisfactory solution.

Mr. Schaub attempts to prove his position by actually obtaining results by the theorem equivalent to those obtained by me. He starts with three equations, (1), (2), (3), as given:

$$2 M_2 (l_2 + l) + M_3 l_2 = -P_1 l^2 (k_1 - k_1^2) \quad (1)$$

$$M_2 = M_3 \quad (3)$$

(1) is from "Framed Structures," (2) and (3) are from his letter.

From (1) and (2) we have

$$M_2 = M_3 = \frac{-P_1 l^2}{3 l_2 + 2 l} (k_1 - k_1^2) \quad (4)$$

From (2) and (3) we have

$$M_2 = M_3 = \frac{-P_2 l^2}{3 l_2 + 2 l} (2 k_2 - 3 k_2^2 + k_2^3) \quad (5)$$

From (4) and (5) we have

$$P_2 = \frac{P_1 (k_1 - k_1^2)}{2 k_2 - 3 k_2^2 + k_2^3} \quad (6)$$

Adding (4) and (5) together, member by member, and dividing by 2, we have

$$M_2 = M_3 = \frac{-l^2}{4 l + 6 l_2} \left[P_1 (k_1 - k_1^2) + P_2 (2 k_2 - 3 k_2^2 + k_2^3) \right] \quad (7)$$

$$M_3 l_2 + 2 M_3 (l_2 + l) = -P_2 l^2 (2 k_2 - 3 k_2^2 + k_2^3) \quad (2)$$

From (6) and (7) we have

$$M_2 = M_3 = \frac{-P_1 l^2}{2 l + 6 l_2} (k_1 - k_1^2) \quad (8)$$

He does not give (4), (5), (6), or (8), but gives (7), without saying how it is derived. However, they are all evidently correct. Placing $P_2 = 0$ in direct violation of (6), he obtains

$$M_2 = M_3 = \frac{-P l^2}{4 l + 6 l_2} (k_1 - k_1^2),$$

which scarcely agrees with (4), and therefore cannot be correct for a continuous truss. It accidently happens to be correct for the partially continuous truss under consideration. (2) and (3) are incompatible if $P_2 = 0$.

He might have cited (4) and said it was correct for either kind of truss with a load, P, placed symmetrically on each of the side spans. In the truss in question, since M_3 must always equal M_2, a load, P, placed symmetrically on each of the side spans should give twice as great a moment as would be given by an equal load in the same position on only one span. This might perhaps have served to indicate a correct solution, but it is rather lame as a mathematical demonstration.

I will say, however, that the moment of inertia of the center span is practically about three or four times as great as the mean for the side spans. The error due to this would be corrected by considering the center span shorter in proportion, so that if the center span be ignored, as is done by many engineers in determining the reaction, the results will probably be more nearly correct than if either Mr. Schaub's formula or mine be adopted.

It is possible that a considerable portion of the present theory of swing bridges will be thrown overboard in a few years by systematic investigations of the exact conditions of the problem, based, perhaps, on the principle of virtual velocities. Very truly yours,

Willis Whited.

New Britain, Conn., Nov. 11, 1895.

(We submitted the above letter to Mr. Schaub, and append his reply.—Ed.)

Sir: It is true that the theorem of three moments is not applicable to the condition of a swing bridge, as set forth in Art. 176, p. 193, "Modern Framed Structures," as far as the shearing forces are concerned; but it is applicable to the condition of bending, if we at all times make M_2 equal to M_3. Owing to the peculiar form of truss used, the latter condition must always be satisfied, and it appears to me that it can be most conveniently done by assuming a load on span l_2 which will produce such a condition.

This may appear as a very lame demonstration, from a mathematical standpoint; but, as a matter of fact, Mr. Whited has employed the same means to satisfy the above condition in assuming the span l_2 as held down at the right hand abutment. This discussion can have no practical value, as it is the common practice to assume the center span l_2 equals zero, when the formulas for a two-span continuous girder are employed.

Yours truly, J. W. Schaub.

Hamilton, Canada, Nov. 25, 1895.

THE COST OF FREIGHT TRAFFIC ON COMMON ROADS.

Sir: It would be unfortuate for the country if the statement recently made by this office of the enormous cost of hauling on the common roads did not awaken interest and discussion. I am glad, therefore, to see you give so much space to the subject, and to have you criticise the statement, and show where it needs support; and, first as to the cost of hauling per ton-mile and the average distance, I cannot imagine any better authority than the farmers themselves, and the table given is simply the result of 10,000 letters of inquiry sent out to farmers selected for their intelligence and experience. We have not attempted "computing" the "cost of hauling a ton a mile." Such an attempt would be futile, in view of the thousand different conditions of the problem in various places and times. Nothing but an actual census of the whole country, such as we have made, could give a safe average of cost. Even your estimate that a team of four horses, at a cost of $3.70 per day, can haul a load of three tons 20 miles per day, for 275 days in a year, will generally be accused of overstating the load, and understating the daily cost, while you forget entirely that farmers' teams do not "go on forever" with their loads, but return empty over the same ground. Again, in comparing the railroad freight on farm products, estimated at $400,000,000, with the $946,000,000 of total wagon freightage, you do not consider that this latter sum includes the haulage of forest products and all farm products hauled elsewhere than to railways, and your comparison becomes pointless. Taking into account the farm products hauled direct to consumers or dealers, or to water transport, the wood fuel, of which very little is shipped by rail, all the secondary hauling of products once marketed, and all the miscellaneous hauling mentioned in my paper, it is not likely that the actual cost of moving "farm products to railways" makes up more than $400,000,000 out of the total of $946,000,000 of wagon freightage, and it is not at all surprising that this cost equals the total railway freight, when we consider how often the mere delivery charges exceed the railway charges, even for long distances.

The argument that a farmer's hauling costs little or nothing, because he does it himself, might have some weight if it could be done in wet weather, when he has idle time, as it is in good-road countries, but it fails entirely here, where bad weather brings bad roads. In the few localities where permanent hard roads have been made in this country, the farmers have either reduced their teams, or increased their product, by hauling lime, plaster, or manure from town when their fields were too wet to work.

If it be true of the average farmer that hauling to market is but "an insignificant fraction" of his year's work, it is neither creditable nor comforting to him, and it is not strange that he is becoming aroused to the need of some change in his condition.

I shall await with interest the definite "information" you ask from your readers, and shall be pleased if the other engineering and agricultural papers will join in this discussion and investigation.

Our office has simply recorded the deliberate judgment of a myriad of experts, and the "impartial critic who sets that down as a 'wild exaggeration,' must have some support besides the 'courage of his opinions.'"

Very truly yours, Roy Stone.

Office of Road Inquiry, Dept. of Agriculture, Washington, D. C., Dec. 7, 1895.

(Whether "the farmers themselves" are good authority as to the average cost of hauling their products to market, would depend very much on how they were approached. Farmers are not, as a class, accustomed to making estimates. They haul their own products to the shipping point almost invariably, and like, other men, they are not apt to undervalue their own work. The real measure of the cost to the farmer is what he can afford to pay for having the work done for him. How much would his expenses be reduced if the hauling to market were done for him gratis? We have already pointed out that the teams which do the plowing and harrowing and mowing and reaping also draw the product to the railway, and would manifestly be standing idle in the fall after the crops are harvested and when the grain is ready for market, were they not employed to draw it.

As to whether the work of hauling his product to the shipping point is an insignificant fraction of the year's work: Let us take wheat, which ranks among the bulky products marketed from the farms. A fair average yield is 16 bushels per acre, or 960 lbs. By General Stone's own figures, one man and a pair of horses in the grain-producing states will draw the product of 2½ acres to the railway at one load. When we consider the time and labor involved in plowing, manuring, harrowing, seeding and rolling these 2½ acres, and in reaping, binding, carting and threshing out the grain grown upon it, it ought to be plain why the average haul to market, even by General Stone's own figures, is an insignificant matter compared with the expense involved in raising and gathering the crop. We fail to see why this obvious fact should be either discreditable or disheartening to the farmers of the country.

The trouble with the farmer is that the total sum which he gets for his products is so small that he has little spare money to pay for good roads. It is a noticeable fact that with all the public agitation on the good-roads question, and the fact that all classes, from preachers to politicians, have joined in the agitation, the farmers, as a class, have steadily refused to put their hands in their pockets and pay the cost of stone roads. This has generally been ascribed to old-fogy ideas and stupidity of the farmers. While there is more or less truth in this, doubtless, we are inclined to give them credit for a larger measure of intelligence, and believe that they appreciate the fact that in a strictly farming community the direct return of hard roads to the farmers has been greatly overestimated.

Of course, in saying this we are speaking broadly and generally. There are, we are well aware, many sections where clay soil or prairie mud makes roads wellnigh impassable in wet weather. There are other sections in which road improvement may operate to build up a suburban or semi-suburban community or a colony of summer residents. The returns from road improvement in all such cases are undoubted.—Ed.)

SIR: As requested in your issue of Dec. 5, I send a few facts concerning the cost of hauling freight over common roads. Between Bound Brook and Fanwood five crushers are located, from which a good deal of carting is done to the railway freight yards. The teamsters are paid 30 cts. per ton, which includes the shoveling of the crushed stone into the cars; the teamsters haul from 6,000 to 8,000 lbs. per load; the distance is about three miles, which makes 10 cts. per ton-mile the amount paid to the freight contractor. The teamsters make four trips daily.

The actual cost of hauling stone is as follows:

I cart crushed stone from Bound Brook quarry to New Brunswick, over a fairly good, level road, and haul 6,000 lbs. per load, making two trips per day:

Price of two horses	$300
" " wagon	90
" " harness	40
Total cost of outfit	$430
Interest on total	$26
Feed and care per year	365
250 days' pay of driver	375
Wear and tear and horseshoeing	50
	$816

Five hundred loads per annum (three tons each) hauled 10 miles to New Brunswick makes 15,000 ton-miles per annum, and dividing $816 by 15,000, we have 5.44 cts. as the cost per ton-mile.

Yours truly, Wm. Haelig.

Bound Brook, N. J., Dec. 7, 1895.

(It will be noticed that in the above statement, as well as in the one given in our editorial discussion, the wages of the teamster is a very large item in the cost of hauling by wagon. For this reason, whenever any great amount of hauling is to be done over long distances, a four-horse, or, better still, a six-horse, team is put to the work, and a material reduction in the ton-mile cost results. Many men now living can recall the days when great freight wagons with six horses or mules were to be seen on every principal highway. We hope some of our readers may furnish us some particulars of the freights charged by these freighters a half-century ago.—Ed.)

WILKES BARRE, SCRANTON AND CARBONDALE, PA.

(Editorial Correspondence.)

The traveler on the Lehigh Valley R. R., after crossing a few miles of the dreary mountain plateau beyond the summer hotel at Glen Summit, Pa., if sitting on the right hand of the train going north, suddenly comes in view of one of the most beautiful landscapes in America—the Wyoming Valley. Down the mountain a thousand feet or more vertically, and about two miles distant in an air line, lies the city of Wilkes Barre, to reach which the train has to go 16 miles down a steep grade along the slope. The valley is from one to two miles wide, and stretches as far as the eye can see in either direction, northeast and southwest above and below Wilkes Barre. The view includes a variety of farm and forest land, and numerous towns and villages, as Nanticoke, Plymouth, Kingston and Pittston, which, with the city of Wilkes Barre, are rapidly becoming one long and narrow city. Electric-car communication between them is building up the territory between with residences.

At Pittston, eight miles above Wilkes Barre, the north branch of the Susquehanna River, which flows through the valley, turns at right angles, going through a pass in the hills of the Blue Ridge, while the valley, now known as the Lackawanna valley, continues in its northeast direction to Scranton, 11 miles, and to Carbondale, 35 miles further. Two prominent features in the landscape which occur at short intervals throughout the extent of both of these valleys are the great anthracite coal breakers and the mountains of culm, or refuse coal, which have been growing larger for over 60 years, a monument to the waste of preceding generations, but which, it is hoped, will in future grow smaller, and ultimately disappear as a more economical age becomes educated to appreciate their value.

The Wyoming Valley, although only five hours' ride from New York, was not settled by white men until about 20 years before the Revolution. In 1778, when the valley had a population of about 2,500, the famous Indian massacre took place, and every white inhabitant was either killed or put to flight. Several months later, the Indian tribes having been subdued, settlers again entered the valley, where peace and prosperity have ever since reigned. The two valleys, the Wyoming and the Lackawanna, between Nanticoke at the southwest and Carbondale at the northeast, a distance of about 45 miles, now contain a population of over 200,000. The census of 1890 gave the following figures for the principal cities and towns: Nanticoke, 10,044; Plymouth, 9,344; Wilkes Barre, 37,718; Kingston, 2,381; Wyoming, 1,794; Luzerne, 2,398; Pittston, 10,302; Scranton, 75,215; Dunmore, 8,315; Olyphant, 4,083; Jermyn, 2,650; Carbondale, 10,833; total, 171,077. Besides these there are many smaller towns and villages, and the population has greatly increased since 1890, due both to the increased production of coal and to the location of new manufacturing establishments in the district.

Coal mining is the leading industry of the two valleys. This, with its geographical location and topography, has made the district a great railway center. Scranton claims no less than 10 railways, counting twice those that pass through it. Leading to the north, northeast and northwest, it has the Delaware, Lackawanna & Western main line, the Jefferson branch of the Erie Railroad, the Delaware & Hudson Canal Co.'s R. R., and the Scranton Division of the New York, Ontario & Western. To the south, southeast and southwest it has the Bloomsburg Division of the Delaware, Lackawanna & Western R. R., the Delaware & Hudson Canal Co.'s R. R., connecting with the Pennsylvania, the Lehigh Valley and the New York, Susquehanna & Western railways, the Delaware, Lackawanna & Western R. R. main line, and the Erie & Wyoming Valley R. R. Wilkes Barre is also about equally well provided.

Wilkes Barre.

Wilkes Barre is the county seat of Luzerne county, a railway and commercial center, not especially noted for manufacturing. It contains the general offices of several of the largest mining companies, is an important depot for mining supplies, and has some foundries and machine shops whose chief business is making machinery and repairs for the coal mines. The city shows evidences of wealth and prosperity—asphalt-paved streets, electric lights, etc.—but there are no signs of a boom or of any great increase in population, although the latter grew from 23,339 in 1880 to 37,718 in 1890. Wilkes Barre would appear to have as many natural advantages as Scranton, which has far outstripped it in population, and the only reason, as far as a casual visitor can judge, is that Scranton's people are a set of "hustlers," while Wilkes Barre's are quiet and easy-going.

Kingston is a suburb of Wilkes Barre, just across the river. The electric car line through its principal street seems to be causing the erection along it of many handsome residences belonging to Wilkes Barre business men.

The Maltby coal mine is on the outskirts of Kingston. The mine has the same general characteristics of all those in the valley—a vertical shaft 300 ft. deep, and a vein sloping about 3° from the horizontal, with gangways driven down the slope for over a mile from the bottom of the shaft. The great coal breaker is of the ordinary wooden construction. The breaker is a few hundred feet from the head of the shaft, and the coal cars, of two tons each, five in a group, are taken to the breaker by an exceedingly simple contrivance—a heavy endless chain wound on a drum by a small vertical engine of about 6 HP. The cars descend by gravity a short distance from the shaft, and then are hooked to the traveling chain, which pulls them to the breaker. Another interesting piece of machinery is the Link Belt Engineering Co.'s system of conveying the fine coal to a storage pile. It is a series of "flights" or flat blades, attached to a moving endless link belt, which drag the coal along an iron trough. The trough becomes polished by the movement of the coal along it, and the sliding friction is surprisingly small.

The Kingston Car Wheel Co.—The chief purpose of the writer's visit to Kingston was to see a remarkable car-wheel molding machine. The president of the company, Mr. Robert P. Brodhead, the senior member of the well-known contracting firm of Brodhead & Hickey, gave every facility for inspecting the machine, together with some photographs of it. A description of the machine, with illustrations, is given in a separate article on another page. The machine has taken several years to develop, but it now appears to be complete, and to be able to do with great speed and precision all that is claimed for it.

The Nottingham Colliery, Plymouth, Pa.—This colliery, one of many in the vicinity of Wilkes Barre belonging to the Lehigh & Wilkes Barre Coal Co., has made a famous record in raising coal from one shaft, which is probably not excelled in the world. There are two cages in the shaft, counterbalancing each other, carrying cars containing a little over two gross tons each. About 1,200 cars, or 2,600 gross tons, are hoisted per day of 10 hours. The shaft is 300 ft. deep below ground, or 405 ft. in depth from the landing platform at the top of the breaker. The hoisting engine has a pair of 26 × 60-in. cylinders, and the hoisting rope winds on conical drums. To mine and handle this amount of coal requires about 700 men in the mines, 170 breaker boys in the breaker and about 100 other men in various parts of the plant. From the bottom of the mine the entries extend over a 5° slope over a mile under ground, running under the Susquehanna River. The tail-rope system of haulage is used in the mine. Pumping is done by compressed air, by which is avoided the great loss due to the condensation in long lines of steam pipe. The compressed air is furnished by a fine plant of Ingersoll-Sergeant piston inlet air-compressors, with steam cylinders 28 × 48 ins., with Corliss valve gear, and air cylinders 34½ × 48 ins. The steam pressure is 110 to 115 lbs., and the air pressure 50 lbs. The capacity is 10,500 cu. ft. of air per minute. Steam is furnished to the compressors by four Babcock & Wilcox boilers of 250 HP. each.

Scranton.

The railway facilities of the city of Scranton have already been noticed above. The population has shown a very rapid growth. In 1860 it was 9,223; in 1870, 35,020; in 1880, 45,850; in 1890, 75,215, and it is now estimated on the basis of the city directory at 103,000. It has long occupied a prominent position in the manufacture of iron. Of the five blast furnaces of the Lackawanna Iron & Steel Co., two were built in 1849, one in 1852 and one in 1854. While it is an important commercial center, it is chiefly a city of manufacturing establishments. According to the "Board of Trade Report" it now has 125 incorporated manufacturing establishments, representing $25,000,000 invested capital, not including coal mines, and it employs in mines, mills and factories 30,000 hands. Its corporate limits embrace about 19 square miles; it has 141 miles of streets and 29 miles of electric street car lines within the city limits. From its general use of electric light and power it has dubbed itself the "Electric City," and from its possession of the mountains of anthracite culm, it claims to offer to manufacturers larger inducements in the line of cheap fuel than any other city in the world. From the number of new and expensive buildings under construction, two of which—the Board of Trade Building and the Jermyn Hotel are especially notworthy—the city appears to be enjoying a period of great prosperity. The Board of Trade is a very energetic body, and it is doing a great deal to advertise to the world the advantages of the city as a location for manufacturers. Its last annual report, which may be obtained from its Secretary, Mr. D. B. Atherton, is a handsomely illustrated pamphlet, containing much interesting statistical and other information. It states that the Board has at its disposal desirable manufacturing sites offered free to those who will permanently locate upon them.

The Lackawanna Iron & Steel Co.—This company was formed a few years ago to consolidate the ownership of the old works owned by the Lackawanna Iron & Coal Co. and the new steel mill owned by the Scranton Steel Co. The former, now known as the North Works, was started in 1840. It now comprises five blast furnaces, one of which is being torn down to make room for the enlargement of one of the others, a Bessemer steel

mill, with three seven-ton converters, and heating furnaces, rolls, etc., sufficient for a production of 200,000 gross tons of steel per annum. The blast furnace plant is a very interesting one, from its showing of how an ancient furnace plant may be modernized. The four older furnaces were built with massive stone stacks of first-class masonry. Instead of tearing down these stacks to make room for the modern slender type of furnace supported on columns, they were allowed to stand, except that their insides were torn out to a cylindrical form of such large diameter that the new iron-cased stack could be built inside of it with an air space all around. The fifth furnace was built in 1872, with a modern iron casing supported on pillars, but at that date furnace builders had not advanced beyond short columns and low boshes with heavy walls. In rebuilding this furnace the short columns with the low entablature, or mantel, were allowed to remain, but the lining of the bosh was made thin, and its plate-iron casing was carried up far above the mantel, which was still used to support the portion of the furnace lining above the bosh. Between the bosh casing and the brick wall above the mantel an air space was left, and several large holes were cut through the wall and outer shell to allow of a circulation of air through this space.

The old engine room is a curiosity. The four blowing engines are of the old-fashioned beam type. The steam cylinders are in one room and the blowing cylinders in another, the beams being supported on the heavy wall of cut stone which separates the rooms. Another engine room contains two modern engines. The casting house is also of unusual construction. Instead of there being a casting house of modern size to each furnace, there is a single very large house running parallel to the row of furnaces.

The old steel works, near the blast furnaces, was built in 1875. It was not in operation on the day of the writer's visit, but it was getting ready to start in a few days. Its chief product at present is steel blooms and billets, but it also makes angles and merchant bars. It has a large rail mill, but with the present limited demand for rails the company makes all the rails it can market in the new or South Works. The South Works are located about a mile from the old works. At the time of their construction they were considered to be some steps in advance of all the other steel works, and to-day, while they cannot be considered to rank with the most improved mills in the West, they are capable of turning out a great quantity of steel at a very low labor cost. During the week ending Oct. 16 the product was 6,775 tons of ingots in 11 turns of 12 hours each, an average of 616 tons per turn. There are only two converters, of nine gross tons capacity each. The ingots are rolled directly into rails without reheating the blooms. There are three stands of 32-in. two-high rolls in line with each other, driven by two reversing engines. One of these engines drives the two stands of roughing rolls, and the other the finishing rolls. One peculiarity of these works is the fact that no Siemens or other gas furnaces are used. The heating is done in ordinary reverberatory furnaces driven by air blast. The cheapness of coal is probably the chief reason why the gas furnaces are not used.

The boiler plant is also unique. It contains 60 boilers in a row, all of the locomotive type, set without brickwork. A sheet iron stack is used for every three boilers. The fuel used is culm directly from the mines, and it is burned on McClave grates with Argand steam blowers, which seems to be the system of culm-burning chiefly used in Scranton and vicinity.

The Dickson Mfg. Co.—This is an old-established concern, well known as builders of some of the heaviest boilers, engines, etc., that have ever been turned out in this country. Their machine shop was one of the first to adopt the modern overhead bridge crane for handling the heaviest kind of work. This building has recently been lengthened, and is now 400 ft. long. Besides the machine shop there is a large foundry and a locomotive and boiler shop. The works are now building among other things heavy flywheels, cranks, etc., for other engine builders.

The Boies Wheel Co.—The specialty of this company is a forged car wheel made in only two pieces—the center, which includes the hub and plate, and the tire. The center is made from wrought iron scrap. The scrap is piled and heated, and then forged in a die under a 20-ton steam hammer into the shape of a round disk. Two of these disks are then heated together and carried to the same hammer, now fitted with a finishing die, and welded, forged and punched into the finished shape of the center. The center is finally bored and turned, the outer edge being formed into the proper shape to make a peculiar kind of locked joint with the inside of the steel tire, which is similarly turned to receive it. The two are shrunk together, and the joint finally finished by rolling a projecting flange or rib, so as to make a practically indestructible joint. The tires are purchased from the regular makers.

Carbondale.

Carbondale now claims to have a population of 15,000, the census of 1890 giving it 10,833, and the growth since that date having been very rapid. It is 17 miles northeast of Scranton, on the Delaware & Hudson Canal Co.'s railway, which goes thence northward towards Albany, via the Albany and Susquehanna Division. It is also the western terminus of the Delaware & Hudson Canal Co.'s gravity railway from Honesdale, and the southern terminus of the Jefferson branch of the Erie Railroad, which runs from Susquehanna on the main line. The Scranton Division of the New York, Ontario & Western R. R., from Scranton to Hancock, on the main line, passes through Carbondale. The city thus has abundant railway facilities.

Carbondale was formerly a mining town exclusively. It was one of the first places in the district where coal was mined for market, and the gravity railroad to Honesdale, on the Delaware & Hudson Canal, was the third railway line in the United States, having been completed in 1829, the same year in which the famous test of locomotives was made at Rainhill, in England, in which Stephenson's "Rocket" came out ahead. The first locomotive ever tried in the United States, the "Stourbridge Lion," was run in a trial trip on this road on Aug. 8, 1829. It was built in 1828 by Foster, Rastrick & Co., of Stourbridge, England, under the direction of the late Horatio Allen, then a civil engineer on the road, who was sent to England to order it. On the trial trip Mr. Allen was the engineer, fireman and only passenger. The trip was made successfully, but the locomotive was never put into actual use, probably because the Stephenson type was shortly afterwards found more desirable.

According to the "Railroad Guide" the distance from Carbondale to Honesdale is 19 miles, and from Honesdale to Carbondale 15 miles. This difference is due to the fact that the road goes by one route and returns by another. The road is 4 ft. 3 ins. gage. To connect with roads of the regular gage in the vicinity, a third rail is laid on the latter. Beginning at Carbondale, the road ascends to the top of Moosic Mountain by eight inclined planes operated by steam engines, and intervening "levels"—that is, slight down-grades, from the head of one plane to the foot of the next. The summit level, between planes No. 8 and No. 9, 750 ft. above the foot of plane No. 1, is about 1¾ miles long. Planes Nos. 9, 10, 11 and 12 descend the mountain, toward Honesdale, and they are operated without motive power other than gravity, the main drum being controlled by a fan and brake-wheel geared from the drum shaft. The fan acts as a drag upon the drum. From the foot of No. 12 the road runs on a uniform grade of 44 ft. to the mile 10 miles to Honesdale. Returning, there are eight elevating planes, Nos. 13 to 20, inclusive, the remainder of the distance being run by gravity. The "level" before reaching Carbondale is a continuous down grade of 14 miles. Until 1877 the road was used for coal only, but since that date passenger trains have been run upon it. Six trains are now run each way daily. The scenery is picturesque, and the trip should not be neglected by the tourist who delights in novel experiences.

Carbondale is now much more than a mining town, and it has considerable importance as a railway and manufacturing center. It is the division headquarters of the Delaware & Hudson Canal Co.'s lines, from Wilkes Barre to Nineveh, N. Y., and the site of the car and locomotive shops of that road, and of the repair shops of the gravity road. It is also the headquarters of the Jefferson Branch of the Erie Railroad. The locomotive and repair shops of the Delaware & Hudson Canal Co. employ about 125 men, and the car shops of the same road employ about 200 men. They build about 10 or 12 passenger cars a year for the main line and an equal number of passenger and freight cars for the gravity road, and also do repairing of coal cars, of which the company owns several thousands.

Van Bergen & Co., Limited, have a large foundry and machine shop, and do a great deal of repair work and some new work, such as making car wheels for the railways of the vicinity. The works are owned in part by the Dickson Mfg. Co., of Scranton. For some years past they have not done a business anywhere near their capacity, but they now have a new Superintendent, Mr. C. W. Whiting, son of the Manager of the great Calumet & Hecla copper mine, in Michigan, who is hustling for business, and will no doubt obtain it.

The Hendrick Mfg. Co.—This concern has a large machine shop of modern construction, employing over 150 men. It is very busy on one of its principal specialties—the making of perforated metal—for screens for coal breakers and for many other purposes. It is one of the best-fitted establishments in the country for this class of work. It also makes refrigerating machines on the ammonia absorption system, hydraulic filter presses and other heavy machine work. The company has recently put in a 100-HP. compound condensing engine built by B. W. Payne & Sons. On the writer's inquiring why a compound condensing engine should be put in where coal was so very cheap, the reply was: "We had to get a larger engine, which, if of the single-cylinder type, would have required a new boiler to give us steam enough, while with a more economical engine the old boiler would furnish enough steam. It cost less, therefore, to buy a high-priced engine than to buy a cheaper engine together with another boiler." This wisdom may be commended to others who are thinking of increasing their steam plants, but it is rather hard on the boiler business.

New Carbondale Enterprises.—Carbondale has an energetic Board of Trade, which is offering inducements to manufacturers to locate there, and it has already met with great success. Three new concerns have recently been located in Carbondale through its efforts.

The Sperl Heater Co., $30,000 capital, manufacturers of hot water and steam boilers for house heating, was formerly located at Susquehanna, Pa., but moved to Carbondale about a year and a half ago.

The Pendleton Mfg. Co., $50,000 capital, makes an all-metal spinning bobbin, chiefly for silk mills. It has a large number of special machines. The bobbin is made either of steel or of non-corrosive alloys. It is formed of three parts—a tubular center and two disk ends. The tube is drawn from sheet metal just as cartridges are drawn. The disks are stamped out, and are fastened onto the tube by a spinning or rolling process. The company has a good business with the largest silk mills in the country. The works were moved to Carbondale from New York city a year ago.

The Klotz Throwing Co., Successors to Klotz Bros., Commission Silk Throwsters, of New York City.—Throwing is another name for spinning of silk. The first spinning operation is done by the silkworm in Japan. The fiber is brought to this country in skeins, as unwound from the cocoon, and is then doubled, twisted and spun until it is ready for weaving. Through the influence of the Board of Trade of Carbondale, a popular subscription of $40,000 was raised by its citizens, and with it a new mill was erected, in which the new throwing company is about to locate. The mill has been deeded to the company by the subscribers, who receive in return a first mortgage of the company bearing 6% interest. The company has $300,000 capital.

The mill is of rather unusual construction, and

is well worth observation by those interested in mill architecture. It is 250 × 150 ft., with substantial brick walls, only one story high, with a basement in which all the shafting is located, the machinery being driven by small belts, which come up through the floor. The building is divided into three bays, each 50 ft. in width, by the columns supporting the iron roof trusses. The central span of the roof has a very large monitor, and the two side spans have each a sort of half monitor, consisting of a vertical glazed side and an inclined roof. Large windows are also placed in the brick walls of the building, placed with their bottoms about 6 ft. above the floor, so that the operatives cannot see out of doors. The Sturtevant blower system of heating and ventilating is used. The floor is of 4-in. plank, covered by 1⅛-in. maple boards. The roof is of splined plank, 3 ins. thick, covered by composite granite covering. The power will be furnished by a 24 × 48-in. Hamilton-Corliss engine, running 100 revolutions per minute. It is expected that the mill will employ 400 hands, and that it will be the leading silk-throwing mill in the country. The spinning machinery is all of special design, and is intended to be run at much higher speeds than that in the older mills. The metallic bobbin above described will be used exclusively.

For the past six months or more the Klotz Throwing Co. have maintained a practical industrial school in Carbondale, for the purpose of educating girls, the daughters of miners and laborers, how to operate the silk-throwing machines, so that when they open the new mill they will have a full supply of well-trained labor. They express themselves as well satisfied with the results of the school.

Brick Street Paving in Carbondale.—Five years ago Carbondale tried the experiment of paving one of its chief business streets with vitrified brick. The result was so good that many other streets have been similarly paved, and no other paving material would now be considered by the town. The first street was paved in bad weather directly on the excavated gravel bed, yet in five years it has cost the city nothing for repairs. A part of it was torn up in laying the electric railway track, and put back unskillfully; but with this exception the paving is practically as good as new. Three years ago Dundaff St., carrying the heaviest traffic of the town, was paved with vitrified repressed and round-corner brick from Cumberland. It was laid on a bed of 4 ins. of concrete and 1 in. of sand, and pitch was run between the joints. The cost was from $2.15 to $2.60 per sq. yd. The pavement to-day appears to be perfect. A contract has just been awarded to the Park Paving Co., of Pittsburg, Pa., for paving 1½ miles of Belmont St.

QUESTIONS USED IN EXAMINATION FOR THE POSITION OF ASSISTANT ENGINEER.

We reprint herewith a couple of lists of questions used in the examination of candidates for the position of Assistant Engineer in the New York State Engineer's office. The examination was held at Albany, Dec. 6 and 7, the examining board being Professor Fuertes, of Cornell University; Professor Wright, of Union College, and Mr. Johnson, City Engineer of Utica. Candidates were required to show their computations on their papers, and books of tables were furnished by the examiners for their use. The questions were as follows:

(First Set.)

1. The angle of elevation of a hill from a station due south of it is 60° and from another on the same level due west of the former and 1,000 ft. distant it is 45°. Find the height of the hill.

2. (a) What is the "hydraulic mean radius" of a channel? (b) What are its values for a circular section running full, a circular section half full, and a trapezoidal section with side slopes one to one and depth equal to one-half the bottom width? (c) Define "hydraulic grade," and what use is made of it in hydraulic engineering?

3. An impounding reservoir is located seven miles from the distributing reservoir, and 500 ft. above it. A cast iron pipe 18 ins. in diameter so laid as to rise nowhere above the hydraulic grade-line, connects the two. Using the formula $V = C\sqrt{rs}$, in which $C = 125$, determine the daily delivery in gallons at the distributing reservoir.

4. If in running a transit line in an open level country you find it passes through a house near the bank of a river, which river cannot be forded or otherwise directly measured across, and having in your possession no books of tables, nor other means of calculating triangles, but only your transit, rods, chain, and boat, how would you pass the obstacle, and continue your line, maintaining upon the opposite side of the river the proper numbering of your stations?

5. An earthen dam is to be thrown across a ravine for the purpose of impounding water; at the site there is 2 ft. of loam, underlying which is a thick stratum of stiff clay. Height of dam from soil to top of proposed spillway is 30 ft. Neglecting all details as to construction of spillway, give cross-section of dam which you would recommend to be built under these conditions, showing dimensions of dam, arrangement of foundation, etc., and make a brief statement of methods to be used in construction to secure a safe water-tight structure.

6. A stone box culvert is to be built across a canal which is 70 ft. wide, and carries 9 ft. depth of water; the material on which it is founded is a fairly tenacious yellow clay extending to an indefinite depth. Dimensions of culvert, 4 ft. by 4 ft., top of culvert located 2½ ft. below canal bottom. Banks of canal are supported by vertical walls of masonry extending to a depth of 1 ft. 6 ins. below canal bottom. Give a cross-section at center of canal showing method of construction you would advise, and also taking into consideration the danger of undermining of structure by percolation of water from canal and by the action of the water in the stream to be carried under the canal, state in a general way what precautions you would take along the whole line of the culvert, but more particularly at its ends and at its junctions with the vertical walls, to avoid danger of having structure washed away.

(Second Set.)

1. What do you consider the essential features of a good engineer's transit, and why?

2. Describe a mode of constructing a puddle wall.

3. In driving piles would you sharpen them or not? Would you drive large or small end down? Give the pertinent reasons that should guide your judgment on this point?

4. For what distributed load per sq. ft. and for what concentrated load would you design a bridge over the canal in one of the populous cities through which it passes? Would you proportion roadways and sidewalks on same basis?

5. Do you consider it advisable to construct any public work requiring in its erection the use of hydraulic cement during freezing weather? If the exigencies of the case are such that the work must be done during freezing weather, what expedients would you adopt to minimize the deleterious effects of frost upon cement?

6. (a) Sketch to scale the section of a retaining wall 20 ft. high to support a bank of material of which the natural slope is 1½ to 1, and the upper surface of which has an indefinite rise of 1 in 3 as it recedes from the wall. (b) Show how you would determine whether or not the proposed section is safe.—(Before answering this question, read the next one.)

7. Write a brief specification for such first-class masonry as you consider proper for the wall mentioned in the preceding question.

AUTOMATIC SWITCH INDICATORS.*

By W. W. Salmon.**

The function of the switch indicator, used in automatic electric block signaling, may be defined as "the giving of an indication at a switch as to whether this switch may be thrown to permit the movement of a train from a siding onto a main track or from one main track to another." The first road to start the installation of such indicators upon any considerable scale was the Illinois Central, which used them on its Chicago terminal automatic electric block system, installed in 1892-1893, under the direction of Mr. W. J. Gillingham, Jr., Signal Engineer of that road.

The indicator used is audible, consisting of an electro-magnetic vibrating bell of special design, enclosed in a box placed on a post at the switch stand. The bell used differs from those used for ordinary annunciator purposes, mainly in the fact that it is better constructed mechanically; the parts that usually fail in such devices having been strengthened or made in duplicate, as, for example, the circuit-closing parts of the device. It is a well-known fact that vibratory electrical devices are subject to considerable sparking and consequent corroding of the contact parts, thus introducing so much resistance into the circuit that a bell may ring only very feebly or not at all. Therefore, a spring consisting of a series of four flexible contacts, provided with a broad plate of corrugated platinum, was used, instead of the ordinary platinum point; the discharge upon break of contact is distributed over a much larger area and occurs at a point distant from the one where contact is finally made. In numerous other respects the device used differs from the ordinary bell, but it is needless to enumerate them in this paper.

The circuit employed is such that when the first wheels of a train enter a block, the bells at all the switches in the section of track between the signal governing this block and the next block signal in advance, begin to ring. The bell at each switch in turn ceases to ring when the entire train shall have passed this switch, unless there are several switches within a few hundred feet of each other, in which case all the bells at these switches continue to ring until train shall have passed the last one of the group. In order to provide against likelihood of trouble from battery failure the signal battery, which is taken out of the signal circuit instantly upon train's entering the block, is used to operate the bells.

The only rule issued by the Illinois Central regarding the use of these bells was as follows:

Each switch is provided with a bell which will ring when a train is approaching it in the block, and switch must not be opened until train has passed.

During the time that this installation was being made, the Kansas City, Fort Scott & Memphis R. R. Co. was making one on its Kansas City terminal similar in all respects, so far as the indicator is concerned, except that here the bell starts to ring when the train reached a point about 1,000 ft. from the block in which the switches were located. This change will be readily seen to be an improvement in that it effectually provides against the opening of the switch at or near the same instant that a train is passing the block signal. This application went into actual service in January, 1893, whereas the Illinois Central application above described was not put into service until the following month. The rules describing and governing the use of the Kansas City application are as follows:

At or near every main track switch there is an electric bell, which will ring continuously whenever a train or engine is approaching on the main track with which the switch is connected; and while any such bell rings none of the switches governed by it should be used, except in emergencies, in which case, after waiting one minute, the switch may be used, if a flagman is sent in the direction of the approaching train or engine a sufficient distance to afford perfect protection.

The next automatic electric block signal system installed using indicators was begun on the Chicago & Northwestern Ry. in November, 1893. While on the two applications above described no failure of the electric bells to perform their work had been noted, it was felt that an open circuit device dependent upon the proper action of its every part for the giving of a danger signal was wrong in principle and might sooner or later give trouble in practice.

Mr. E. C. Carter, Principal Assistant Engineer of the Chicago & Northwestern Ry., therefore, determined to use a visual indicator operated on the normally closed circuit plan, and so installed that in no case could the breakage of the indicator wires or failure of battery or other parts of the complete device cause it to give a clear indication falsely. The indicator employed consists of a circular red disk attached to the rotary armature of an electromagnet and placed in a water-tight cast iron box, fixed with a post set opposite the switch. In the front of the box is a circular plate glass window slightly larger than the indicator disk. The disk is so placed as to be visible through this window when the electromagnet is discharged; this is to say, the disk falls by gravity to its position back of the window, when for any reason the indicator battery ceases to pass through the coils of the electromagnet controlling its operation, and conversely, it is drawn up out of sight when the current is passing through the coils.

In this application, when a train approaches within about 2,000 ft. of the block in which there are switches, the indicators at each siding switch in this block and at the main line cross-over switches in the opposite track are all set to danger. The indicator at each switch in turn is cleared as the train passes this switch; or, if a number of switches are closely grouped, all indicators in each group are cleared when train passes last switch.

It will be noted that here, aside from the employment of the visual instead of the audible indicator, another feature has been introduced, namely, that of setting the indicator to danger at the switch in the other main track in the case of cross-overs. The chief reason for doing this was to prevent the possibility of a trainman's setting the cross-over switch in the track occupied by his train and permitting this train to proceed toward the other main track before he discovers that another train is approaching on this latter track. Rules governing the observance of these indicators are similar to those on the Kansas City, Fort Scott & Memphis R. R. except that the original installation having been on wire circuit, the following rule is given:

A train allowing another train to pass it shall not come out on the main track until the train which has passed shall have reached the next signal, or had ample time to do so; but shall open the switch leading to the main track in order to keep the signal back of the switches at danger for its own protection.

* A paper read before the Railway Signaling Club, Dec. 10, 1895.

** General Agent, Hall Signal Co., Chicago.

The next style of application is the one in most general use, and is, I believe, used altogether on recent automatic electric block systems installed in the East. It differs from the one described as being in use on the Chicago & Northwestern Ry. chiefly in the fact that it is cleared only when the entire train shall have passed out of the block. One of the latest of the applications of this kind was placed in service on the Chicago, Burlington & Quincy suburban line between St. Louis and West Alton in November, 1895. The rules and special instructions regarding these indicators are as follows:

At each switch within the limits of the block system is placed an "indicator." These indicators will display a red disk by day and by night. (No light at night.)

When a train has approached within one-half mile of a block signal the indicators at all siding switches in the block section governed by this signal will be set to danger and will remain at danger until train shall have passed 2,000 ft. beyond the next signal. The train will also set to danger indicators at train line cross-over switches in the other main track, but will not affect the indicators at main line cross-over switches on the track on which train is running.

When a train is about to move from a siding onto main line, trainmen must first observe position of indicator at siding switch. If this indicator is "clear," switch may be thrown and train may proceed out on main line. If the indicator shows danger, switch must not be thrown until flagman has been sent out as required by flagging rule No. 99.

When a movement is to be made from one main track to the other, trainmen must first observe position of indicator at cross-over switch in the track occupied by their train. If this indicator is "clear," this switch must be thrown first; then the other switch of cross-over may be thrown and train may proceed. If, however, this indicator is at "danger," neither switch must be thrown until flagman has been sent out as required by flagging rule No. 99. If, however, an indicator is known to be out of order, or if from any cause it becomes necessary to use a switch before such indicator shows white, such switch must not be opened until flagmen have been sent out in accordance with the usual precautions and rules. If the indicator does not show a red disk after a switch has been opened, it signifies that the block signal has failed to go to danger. In such case, movements must be made under the protection of a flag.

In this application it will be noted that the indicator acts as a block signal, giving, when clear, equal rights to a train to proceed at speed into any portion of the block precisely as though the train were entering under the clear block signal itself, the necessity for flagging in such case being disposed of.

The Michigan Central R. R. indicators are controlled and operated in practically the same manner, except that a circuit-closing device is used on the block signal, to prevent the indicators from going to danger upon the opening of a switch while the block signal actually occupies the danger position. The rule relative to this particular feature is as follows:

No switch must be opened excepting under the protection of a flag when the indicator at that switch shows a red disk, until it is ascertained that the block section protected by the semaphore connected with such indicator is not occupied and that no train is approaching such semaphore.

If the indicator does not show a red disk after a switch has been opened, it signifies that the semaphore has failed to go to danger. In such a case movements must be made under the protection of a flag.

In the above description, the purpose has been to select representative applications of these indicators and to point out as briefly as practicable the essential features of difference between them. It is probable that one style is better adapted to certain conditions than another, and that each will, therefore, have its advocates and its critics. It is to be hoped that in the discussion of the paper any faulty or dangerous features of the practice now prevailing in the use of these indicators will be pointed out. This is particularly to be desired since the use of these indicators is a comparatively new thing, and even on the dozen or more roads where they are employed it is probable that if it is demonstrated that the present practice is not the best adapted to their purpose they could make necessary changes at small cost now, whereas, after a few years such a change would probably entail considerable outlay.

THE KINGSTON CAR-WHEEL MOLDING MACHINE.

The flask in which a car wheel is molded consists of two parts, an upper and a lower, called respectively the cope and the drag. The cope

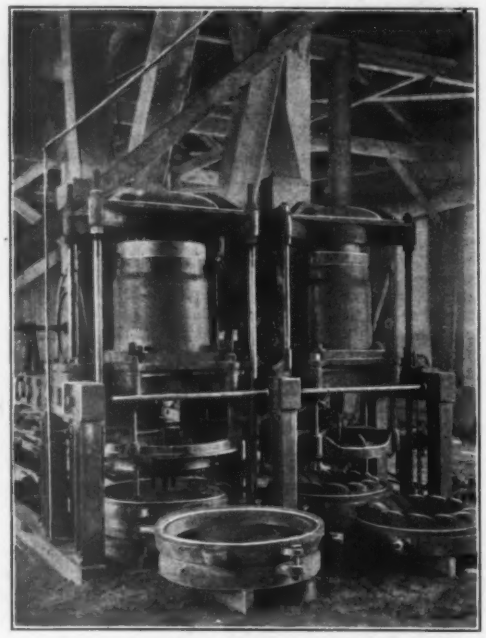

Fig. 1. Front View of Kingston Car Wheel Molding Machine, showing completed Cope and Drag.

corresponds to the outer, and the drag to the inner face of the wheel. The outer face of the wheel is usually a plain or slightly concaved disk, while the inner face is deeply ribbed with radial or curved ribs. In hand molding the sand is carefully rammed into the two halves of the flask from their outer sides, the work requiring a high degree of skill. A day's work for a molder and two helpers is the molding of about 20 wheels.

The advantages of machine molding for castings of which very large numbers are required from a single pattern are now well recognized, but various difficulties have heretofore stood in the way of attempts to apply machine molding to car wheels. We believe the machine illustrated in the accompanying engravings is the first successful car-wheel molding machine ever constructed. Its development has been the work of some years, but a complete machine has been finally built and is in operation at the works of the Kingston Car Wheel Co. at Kingston, Pa., a suburb of Wilkes Barre, and was there examined by a member of the staff of this journal.

As stated above, 20 flasks per day is an average day's work for a molder and two helpers in a car wheel foundry. The Kingston car-wheel molding machine can turn out 200 flasks per day, and the machine is automatic in every respect, requiring no skilled molders to operate it. The operation of the machine is in general as follows:

The copes and drags are placed in position on a feeding device, which delivers them to the machine. An elevator carries sand up to a platform above the machine, whence it descends into two measuring devices, which deliver the exact amount of sand required respectively by the cope and the drag. These are then moved automatically to hydraulic presses, which press the patterns of the inner and outer sides of the wheel into the sand, and when the pressure is relieved the machine then carries the two half molds to the delivery end of the machine, whence they are taken away to the pouring floor.

Described in greater detail, the apparatus consists of two separate machines built side by side, one for molding the cope and the other for the drag. The motions of the two sides are nearly similar, a slight difference being made in part of the operation on account of the different forms of the outer and inner faces of the wheel.

Observing the machine from the front, as in Fig. 1, we see two vertical hydraulic presses, their bottoms being elevated about 2 ft. above the floor. The plunger of each press has a stroke of 18 ins., and raises a cross-head, which carries by four suspending rods the movable platen, or table. Underneath the press is attached a half pattern of a wheel. The movable table having the half flask placed upon it in precisely the proper position, with the loose sand in it already formed by a previous operation into the approximate shape of the pattern, is elevated by the action of the hydraulic cylinder and pressed with great force against the pattern. On the pressure being relieved, the table with the half flask descends to its lowest position, and another motion of the machine pushes the half flask out to the delivery table. The two sides of the machine operate simultaneously, so that a cope and a drag are molded at the same time.

Taking a side view of the machine, on the side on which the drag is molded, Fig. 2, we see a framework extending to the rear about 8 ft., within which the preliminary operations of filling and partially forming the loose sand in the drag take place, and beyond that for about 20 ft. a movable pair of rails, by which the drags are fed into the machine.

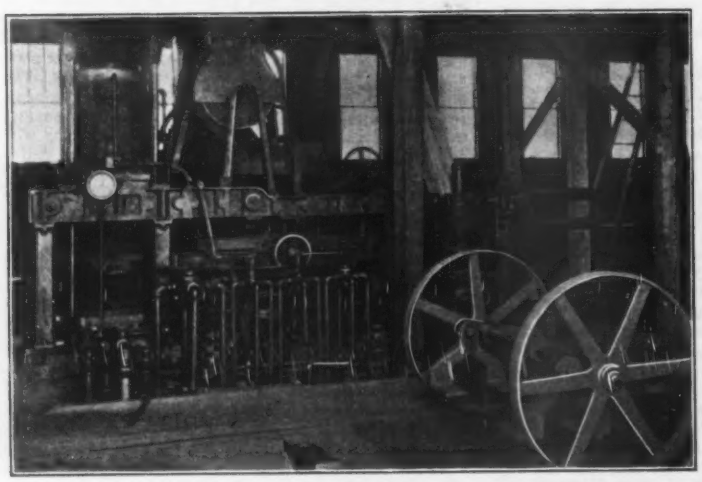

FIG. 2. SIDE VIEW OF CAR WHEEL MOLDING MACHINE, SHOWING HYDRAULIC PRESSURE PIPES.

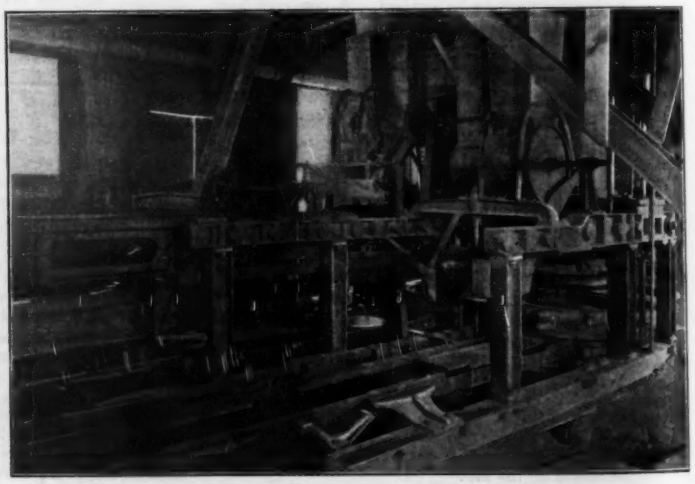

FIG. 3. REAR VIEW OF CAR WHEEL MOLDING MACHINE, SHOWING RACKS FOR ROTATING FLASKS.

Beginning at the outer end of these feeding rails (see Fig. 3), the operation is as follows: An inverted drag, or half flask, is placed upon a pair of stands which are just outside of the rails. A pair

of lugs upon each of the stands automatically center the drag in the exact position. A horizontal hydraulic cylinder, set in line with the center of the machine at the rear, then causes the rails to move in such a manner that they first lift the drag off the stands about ½ in., then move it forward 4 ft., then lower it onto a second set of stands, then return to their first position, where they are ready to move in like manner the next drag, which meanwhile has been placed upon the first pair of stands. When the second drag is moved, the first moves another 4 ft. When this operation has taken place five times, there is then a procession of five drags on the feeding rails, each of which is advanced one stage at every forward stroke of the hydraulic cylinder. Returning to the first drag, the next motion of the machine carries it into the position in which it is to receive the sand. A table moved by a hydraulic cylinder elevates it about 3 ft.; another motion carries it over a casting which contains a form of approximately the shape of the inner side of the wheel, which has already been supplied with the proper amount of sand. The inverted drag is then lowered onto the form, the form and drag are then together turned upside down, which motion transfers the sand from the form to the drag, the latter being now right side up. The drag, with its sand shaped approximately to the shape of the pattern, is now lowered to the level of the press platen, pushed forward onto it, and then raised by the hydraulic press against the pattern, as already described.

The sand is delivered into the form before the latter is covered by the inverted drag, by means of a revolving measuring hopper, which is graduated so as to contain the exact quantity of sand necessary. Just below the funnel which receives the sand from the hopper is a wooden roller, the face of which is shaped to conform with the inside or bottom of the drag. As the sand falls into the form, the latter is rapidly rotated horizontally by a rack and pinion for 10 or 12 turns, and as the sand passes under the roller at each rotation it is pressed loosely into the form, and at the same time made of the shape of the bottom of the drag. By varying slightly the form of this roller a greater or less thickness of sand may be placed in any portion of the form that may be desired, so that if it is thought necessary that one portion of the mold in receiving the final pressure should be pressed harder than another, this can be accomplished at will by thus varying the thickness of the sand to be subjected to the pressure. The average thickness of the sand in the flasks is about 1½ ins. Venting is provided for by the bottoms of the flasks being perforated with a great number of ½-in. holes.

On the other side of the machine (the cope side) the operations are essentially the same, except that the cope is carried onto the machine right side up, and there is no form for receiving the sand previous to its being placed in the flask. The cope receives its sand directly from the measuring hopper, and it is rapidly rotated under the distributing roller, so as to cause the sand to take approximately the shape which is finally given to it by the pattern.

After the machine is once started, all the operations being consecutive, it is practically automatic. The whole of the machine is operated by six hydraulic valves, the levers of which, except one, are all attached to the machine itself and opened and closed by it. Of the six valves, the first, operated by hand, moves the feeding rails, the second operates the table that raises the drag, the third raises the cope and the form which receives the sand for the drag, the fourth brings the drag forward to the preliminary form, the fifth turns the drag right side up, and the sixth operates both hydraulic presses. The rotating of the form and of the cope while receiving the sand is done through the rack and pinion by the backward movement of the feeding rails.

The limit to the speed of the machine is that of placing the copes and drags upon the stands at the rear end of the feeding rails, and that of taking away the finished molds from the front of the machine. One complete mold—that is, both cope and drag—have been made and taken away in a minute and a half.

We are under obligation to Mr. Robert P. Brodhead, President of the Kingston Car Wheel Co., for the opportunity to inspect the machine, and for the photographs from which our illustrations are prepared.

MAIL CARS FOR THE BROOKLYN CITY ELECTRIC RY.; BROOKLYN, N. Y.

The use of mail cars on city and suburban electric railways is being extended very rapidly, and a number of cities are now accommodated with this class of service. The Atlantic Ave. R. R., of Brooklyn, N. Y., has for some time had combination mail and passenger cars in operation on its suburban line to Coney Island, as described in our issue of July 11, 1895, and the Brooklyn City R. R., of Brooklyn, N. Y., commenced operating mail cars on Dec. 18. Five large combination mail and passenger cars have been built for this latter company by the J. G. Brill Co., of Philadelphia, Pa., and on Dec. 16 the railway company ran an excursion with these cars to exhibit them to a number of street railway men and others interested. The cars are 35 ft. long over all and the 24-ft. body is divided into two compartments 12 ft. long and 7 ft. 4 ins. wide. The platforms are 4 ft. 6 ins. long, with rounded dashboards. The mail compartment, at the forward end of the car, is fitted with the standard mail car fittings, including 200 pigeon-holes, a pouch rack, sorting table, etc. This compartment is entered by side doors only, and there is a small window in the partition through which stamps can be sold to persons in the passenger compartment. A drop box is also provided at each side. The passenger compartment has accommodation for 20 passengers. There are six cross seats with reversible backs, arranged as in steam cars, and a fixed seat against the partition and the end of the car, the end door opening onto the side of the platform. The seats are of Hale & Kilburn make, covered with spring rattan. The interior finish is of cherry, and in each window post is a push-button to ring the platform gong and signal the conductor to stop.

There are ten lights and a Central Co.'s electric heater in the mail compartment, and eight lights and a Consolidated Co.'s electric heater in the passenger compartment. Platform lights and electric headlights are also provided. The cars are mounted on two Brill maximum-traction four-wheel trucks, in which the greater proportion of the weight is carried by the larger wheels, on whose axles the motors are mounted (Eng. News, Jan. 24, 1895). They ride very easily on the new heavy tracks. The motors were made by the Westinghouse Electric & Mfg. Co., and the controllers by the General Electric Co. Each car is fitted with a Crawford fender and fixed wheel guards.

The cars are very handsome, the outside of the body being painted white, picked out in red and gold; and the interior having natural wood finish of light color and veneer headlining. The cars will be run upon a regular schedule from the Post Office and the City Hall to Hunter's Point (by way of Myrtle Ave. and Washington Ave.), and also to East New York (by way of Fulton St.). Several sub-post-offices will be served on these routes.

DEFICIENT CARRYING CAPACITY OF THE 48-IN. STEEL WATER SUPPLY MAIN OF NEWARK, N. J.

All who have followed the development of the works built by the East Jersey Water Co. for the supply of Newark, N. J., and the various allegations regarding their deficient capacity and failure at other points to comply with the contract, will be interested in the statements given below. In fact, these statements will be of interest to all hydraulic engineers. They are to the effect that a 48-in. riveted steel pipe line, designed to carry 50,000,000 gallons a day, has been found in practice too small. In explaining how this came about, all other computations for long lines of large riveted pipe made since 1877, in this country and Europe, are put in the same category—unless a sufficient margin was allowed in actual practice to make up for the deficiency. The responsibility for all these years of hydraulic blundering is placed on imperfect and inadequate observations of the discharge through the Rochester water supply conduit, made in 1877. These gagings, it is said, have been the basis for all subsequent calculations on the flow of water through long lines of large riveted pipe.

The statements to which reference has been made are in the form of a communication to the East Jersey Water Co., from its Chief Engineer, Mr. Clemens Herschel, M. Am. Soc. C. E., and through the courtesy of Mr. Herschel are given in full as follows*:

To the President and Directors of the East Jersey Water Co.:

Gentlemen: So soon as the supply of water by this company to Jersey City commences, presumably this current month, the exact carrying capacity of the Newark conduit will be determined, because Jersey City probably will want to consume more than this conduit can at present supply.

In our negotiations with Jersey City this has been taken into consideration, and we have not offered to cause the conduit to carry all that Jersey City might need, or so much as 50,000,000 gallons daily. What its exact carrying capacity is, under the contract hydraulic gradient, or under any other gradient, I have not hitherto determined, but from incidental observations that have gradually accumulated, and especially by a reasoning from analogy in the light of recent results, found by experiment on the conduit at Rochester, N. Y., I have no doubt that under the contract hydraulic gradient the discharge will be less than the contract requirement, and it is proper that a statement should be made at this time how this deficiency has been occasioned.

The computation of the carrying capacity of a long line of pipe must necessarily be based on experiments in the past on similar pipes. No other way is open. And should past experiments have been falsely reported, that would correspondingly deceive the builders of similar pipes later on. This is precisely what has happened in the case of large, riveted steel conduits.

The first pipe of this sort larger than 20 ins. in diameter experimented on was the pipe laid by the city of Rochester, N. Y., in 1876. In the Rochester city reports for 1877 this pipe, 30 and 24 ins. in diameter (but having a different hydraulic slope or gradient on the 30-in. portion from the slope it has on the 24-in. portion), is reported to carry 9,292,800 gallons per 24 hours. This report stood unquestioned, being an official report, until after our Newark pipe-line was nearly completed, when it was discovered that the Rochester pipe was carrying only 7,000,000 gallons per 24 hours. During the intervening 14 years the city engineer's report of 1877 had deceived all the engineers and writers on hydraulic engineering, here and in Europe, who had given the carrying capacity of riveted pipe any attention. Among them I could name Hamilton Smith, Unwin, Fteley, Kuichling and myself and many others, all of whom are in print or otherwise on record to that effect.

When called upon to design the Newark conduit in 1889, I thought I was proceeding with more than usual prudence by engaging Mr. Kuichling, who had been an assistant engineer on the Rochester conduit and its mechanical designer, to be my principal assistant in the design of the Newark conduit. His computation of results I myself repeated or checked, by using the book called "Hydraulics," written by Hamilton Smith, who had had a large experience with riveted pipes in California, and whom I knew, from a personal acquaintance, to be a most conscientious hydraulic experimenter and engineer. Though the results of Kuichling's independent computation, made by a totally different method, agreed almost exactly with my results, yet it is plain to-day, but was not then, that this carried no proof of correctness with it. It merely demonstrated that all writers and workers in this line for 14 years then past had been equally misled by the erroneous statements of the Rochester Water-Works Report of 1877.

It is only within a few weeks that I have, for the first time, been told how the 1877 Rochester report came to state a discharge of over 9,000,000 gallons per 24 hours for a pipe that palpably never has carried more than 7,000,000 gallons per 24 hours.

I learned that the assistant, who had been charged with the duty of gaging the discharge of the Rochester conduit in 1876, by observing the rate at which it filled the city reservoir, was then a man about 65 years of age. The work was done in the winter, and he delegated to a gate-tender employed by the city the actual reading of the gages, only noting down the reports thus procured in his note book. This note book showed four gagings, ranging from 7,000,000 to 12,000,000 gallons per 24 hours; which circumstance alone should have caused them to be rejected as worthless; because, if accurately and truthfully done by the method of reservoir filling described, such gagings

* For a full description of the Newark pipe lines, see Engineering News, Aug. 1 and 8, 1891, and July 13, 1893.

should not have varied so much as 2% from the average, instead of ranging from 7,000,000 to 12,000,000 gallons.

From these gagings the discharge of the Rochester conduit was officially reported, in 1877, to have been 9,292,800 gallons per 24 hours, with nothing to authorize such a statement, except four pretended gagings, ranging from 7,000,000 to 12,000,000 gallons. But this report, such as it was, became standard authority, being an "official" report, and was taken as the truth for 14 years.

It is this train of evil circumstances that has inflicted damage on this company, and has led to a small deficiency in the Newark pipe, which must be made good before Sept. 24, 1900, in order to comply with the terms of the Newark contract.

To make a specific compliance with the contract, we would have to lay a small pipe alongside of the 48-in. conduit, to carry the deficiency.

Without being obliged to do so, this company, fortunately, built the intake gate-house, so that two 48-in. or two smaller conduits, or a 48-in. and one smaller pipe, can at any time take water from the intake pond. The right of way deeded to the city of Newark is wide enough for one or more additional pipe lines; and this company has the right to carry the contract quantity of 50,000,000 gallons in one pipe line, or in two, at its own option. So that there is nothing to prevent this company from making a specific compliance with the contract, by laying a second small pipe.

Nevertheless, it would be a wasteful and unbusinesslike method of accomplishing the desired object. That is, of making a channel that would carry 50,000,000 gallons per day to the Belleville reservoir; and one bringing disadvantages with it, to both the interested parties. It would spoil the second outlet from the intake gate-house for a second 48-in. conduit such as would provide for Newark's future requirements, and would create a needless line of small pipe, 21 miles long, to be maintained and operated forever.

A better and more sensible way would be to improve the occasion by constructing a second 48-in. conduit, by the joint efforts of the city of Newark and of this company. There is no especial virtue in the figure of 50,000,000 gallons daily as measuring the needs of the city; and two such conduits, each of a somewhat less capacity, but with a much greater aggregate capacity, would be ample for the needs of Newark for a great many years, especially if the sources of supply were to be increased, as suggested further on. Two such conduits would constitute an effective safeguard against a possible interruption to the supply of water; for it must be remembered that these conduits are put out of service, not by "breaks" or "bursts," none of which have occurred, or are likely to occur; but by little defects, such as a cracked casting riveted on at some side connection; or by the necessity of making examination of the interior, or for some such minor reason. And it would be of essential value at such times to be able to have one conduit remain in service.

By our contract with Jersey City for a temporary supply, and by the prospect of needing much more water for our various customers and allied companies, and for future customers, we are now placed in a position where we have a substantial interest in increasing the carrying capacity of the conduit, or conduits, at once, and in the possibility of using them after 1900. More than this: We can afford to expend a reasonable amount of money for the purposes of increasing the sources of supply along the line of the conduits, by means of other reservoirs and branch pipe-lines. If, therefore, the city of Newark be disposed to make a supplemental agreement with this company, I think that both the parties to this agreement can profit by the operation; and that this view should be fully considered by both parties before further construction is entered on. Respectfully yours,

Clemens Herschel,
Engineer and Superintendent, the East Jersey Water Company.
No. 2 Wall St., New York, N. Y., Dec. 7, 1895.

A SUIT FOR FAILURE OF WATER-TUBE BOILERS.

On Nov. 19, 1894, a suit was begun by the Philadelphia Edison Electric Light Co., of Philadelphia, against the Abendroth & Root Mfg. Co., of New York city, to recover $34,000. A countersuit was put in by the Abendroth & Root Mfg. Co. against the Philadelphia Edison Electric Light Co. for $6,830.99. This suit was tried in the United States Court in Brooklyn, before Judge Wheeler and a jury, and a verdict has now been rendered in favor of the Abendroth & Root Mfg. Co., for the amount of the countersuit. The following notes of the trial have been furnished us by the Abendroth & Root Mfg. Co.:

The Abendroth & Root Mfg. Co. are the manufacturers of the well-known Root water-tube boiler, and between 1889 and 1891 they furnished the electric light company with about 3,500 HP. of boilers.

Soon after these boilers were erected and in operation in the Philadelphia Edison plant, a series of troubles occurred, which finally culminated in a fatal accident, and, in the Coroner's Court in Philadelphia, after a careful investigation by a jury of experts, a verdict was rendered acquitting the Abendroth & Root Mfg. Co. and holding the Electric Light Co. responsible.

The troubles were due, as claimed by the Electric Light Co., to bad workmanship, bad material and faulty design, and they brought suit to recover $34,000, which they claimed they had spent in remedying the so-called defects.

The Abendroth & Root Mfg. Co. claimed that the plaintiffs had not paid them all that was due on their orders for boilers, and also for additional material furnished, and on these grounds brought the countersuit. On the trial they established the fact that they had lived up to every article of their agreement, and that they had used the best material obtainable in the market.

The greatest number of breaks occurring in these Edison boilers were reported to be in the item of bolts. When these bolts broke, in almost every instance a curious phenomenon occurred. At the point of fracture, the metal, instead of being contracted to a smaller area than that of the bolt itself, retained the original size and area, showing no contraction whatever, but breaking sharply and squarely, like a pipe-stem. This caused the question to be raised as to whether crystallization had occurred, and, to determine this point, many of these bolts were taken to a steam hammer and flattened out cold to less than ¼ in. in thickness. In every instance the flattening was done without the slightest show of fracture running up into the body of the bolt, whereas if crystallization had taken place at the point of rupture the metal would necessarily show brittleness and breakage similar to the action of a piece of cast iron similarly treated. Another test applied to many of these bolts was to bend them double when cold, so that the two ends met, and this also proved the excellence of the quality of the bolts. In order to show that no effort had been spared to improve the quality of the material used, the Abendroth & Root Mfg. Co. had other bolts made of the best rivet iron, substituted in the place of the original ones, but all such bolts were fractured in identically the same manner, and a still further trial was made with steel bolts, which broke in the same manner. In order to make this breaking point test still stronger, ⅝-in. bolts were substituted for the ⅝-in. bolts, but with no better results. Beyond this, the shape of the head, and also the shape of the lug which received the head of the bolts, were changed in every conceivable way, but all to no avail, as the fracture of bolts continued in this almost unaccountable manner, whereas fracture in the other parts of the boiler was very infrequent indeed.

To answer the allegation of bad workmanship, the Abendroth & Root Mfg. Co. showed by means of photographs the tools which they now use in the manufacture of their boilers, and they proved that these same tools had been used in manufacturing all of the boilers supplied to the Philadelphia Edison Co. As these tools are made to produce interchangeable parts, it was found impossible for the plaintiff to show that such workmanship could be other than that produced in the many boilers manufactured by the Abendroth & Root Mfg. Co. Moreover, as such trouble as was experienced in the Philadelphia Edison station has never been known in other plants, it stood to reason that with workmanship and materials the same, all the troubles at the Edison station must have been due to local conditions existing in the plant itself. This same argument bore also on their claim of bad design.

The Abendroth & Root Mfg. Co. succeeded in proving that the accidents were due entirely to the unreasonable handling of the boilers by the Edison Co., with the object of forcing these boilers far beyond their rated capacity, sometimes exceeding this rating by as much as 100% and over. They also showed that the Edison Co. employed unskilled labor, and that these employees had instructions to keep steam up to the required pressure, and to keep the lights going, which the Edison Co. had contracted to supply, without regard to the personal safety of the attendants or capacity of the boilers.

One of the very important matters brought to light was the use of extremely bad feed-water. It seems that the Edison Co. sunk a well beneath their station, and this was the only water they used to supply their station. This water, as was shown by the analysis presented during the trial, contained not a small amount of sewage, and had 34 grains of impurities to the U. S. gallon, almost 8% of these impurities being proved to be sulphate of lime; while salt existed in appreciable quantities, and also a number of nitrates and ammoniacal salts. In order to counteract the bad effects from this water, chemicals were used. These were changed at times, and finally the Edison Co. seemed to settle down on the use of cutch, or catechu, which contains a considerable quantity of tannic acid. In the storage tank located above the boilers large quantities of caustic soda were also put in the water. The result of the use of this bad feed-water was naturally shown in the collection of a large amount of scale in the tubes, varying in thickness from 5-16 in. to 1 in., and thereby closing down materially the area of the tube opening. The chemicals used attacked the metal parts of the boiler and oozed through the joints thus attacked so as to form hard incrustations, which had at times almost entirely covered the bolts and bends. This state of affairs caused a rigidity of parts which were designed to be flexible, and it also caused the unnecessary burning out of many of the tubes.

It was further established by the evidence that an excessive forced draft was used, and that this draft was sufficient at times to support a column of water 3 ft. 4 ins. in height.

One of the most interesting points developed was the production of water hammer in the tubes of these boilers, which was explained in the following manner: It is a well-known fact that every pipe or tube has a definite capacity of discharge, and when this capacity is reached no more water or steam can be delivered through an opening of such an area; so that, in case a larger discharge is required, a larger tube must be used. In driving these boilers to such an excessive extent, in the course of natural circulation the water and steam passed up along the inclined tubes to the front headers and there advanced upward into the overhead steam and water drums, from which the steam was delivered to the piping system. When the circulation reached a point equal to the capacity of the tube, of course, no more steam or water could be discharged from that upper end of the tube, but as the heat still continued to be applied around the tube, more steam was generated, and, of course, the pressure of this steam in the tube forced the steam and water back down the tube until it reached the rear header, and here the steam suddenly had a chance to escape upward by the course of the rear headers to the overhead steam and water drums, and the colder feed and circulating water trying to enter the lower end of the tubes from these same rear headers came in contact with the steam thus seeking a passage of escape. The result was a sudden condensing of the steam, which was followed by a rush of water into the vacuum at an exceedingly high velocity, and this water rushed along the tube at about this same velocity until it reached a bend at the end of the tubes. The result was a very sudden and powerful blow there, which caused the bolts to rupture in the manner above described, breaking them, in fact, so rapidly that a flow of the metal composing them at the point of rupture was impossible.

The consequences of this sudden blow was exhibited in the breakage of these bolts without contraction of area at the point of rupture. It was remarked during the course of the trial that it was fortunate that these boilers were composed of small headers covered by small castings known as connecting bends, and that thus the damage done affected merely these small castings, producing there local results instead of rupturing large castings, which would, of course, be attended by far more serious ruptures. Glass models were shown at court which illustrated the theory thus presented. Other glass models illustrated the irresistible power of the water hammer, the force of which was sufficient to break the tubes, which held the water surrounded by a vacuum.

The counsel for the Philadelphia Edison Co. were Tracy, Platt & Boardman, and the counsel for the Abendroth & Root Mfg. Co. were Benedict & Benedict and Witter & Kenyon, of New York. The plaintiff brought in as an expert, Professor Spangler, of Philadelphia; while the defendant brought in as experts Dr. C. E. Emery, of New York, and Prof. R. C. Carpenter, of Sibley College, Cornell University, Ithaca. Prof. W. D. Marks, of the Philadelphia Edison Co., and Mr. Albert A. Cary, of the Abendroth & Root Mfg. Co., also testified as experts on their respective sides.

Measurements of the increase in the water of streams in Colorado from the return of waters applied in irrigation have been continued this year by Prof. L. G. Carpenter, of the Colorado Agricultural College, with the co-operation of the State Engineer. The Cache à la Poudre River, in a distance of 40 miles, gained 164 cu. ft. per second in 1895, as against an average of 100 cu. ft. in previous years. The South Platte River, in a distance of 150 miles, gained some 600 cu. ft. per second. In the latter stream losses were shown in the unirrigated districts. The results of the past ten years of measurements are soon to be printed in the form of a bulletin by the Experiment Station, which can be obtained on application.

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PERSONALS.

(Readers are requested to contribute items of interest for publication in this column.)

Mr. George H. Innis has been elected Street Commissioner of Boston, Mass.

Mr. Albert G. Betscher, contractor, of Hamilton, O., died Dec. 6, at the age of 38.

Mr. George Chadwick, contractor and builder, of Bellevue, Ky., died suddenly Dec. 12.

Mr. T. W. Adam has been appointed Master Car Builder of the New York & New England R. R.

Mr. A. E. Tripp, Assistant Engineer in the Department of Public Works, Cincinnati, O., died Dec. 8.

Mr. B. Lantry, of B. Lantry & Sons, railway contractors, died at Strong City, Kan., Dec. 7, at the age of 63.

Mr. C. C. Strasser has been engaged as Superintendent of the Mount Carmel Light & Water Co., of Mount Carmel, Ill.

Mr. H. C. Robinson has been appointed Assistant Superintendent of the Southern Division of the Boston & Maine R. R.

Mr. Warren Houghton, of Bath, Me., the head of the old shipbuilding firm of Houghton Bros., died at Bath Dec. 13, at the age of 90.

Mr. J. C. Dunlap, C. E., of Ontario, Cal., is to have charge of the surveys of lands to be irrigated under the Gage Canal at Riverside, Cal.

Mr. J. R. Lane has been appointed Superintendent of the Macon & Birmingham Division of the Georgia Southern Ry., with office at Macon, Ga.

Capt. Frederic V. Abbott, U. S. Corps of Engineers, has been ordered to relieve Maj. Ernest H. Ruffner, Engineer of the Sixth Lighthouse District.

Mr. W. F. Merrill, General Manager of the Chicago, Burlington & Quincy R. R., has accepted the position of Second Vice-President of the Erie R. R.

Mr. A. J. Cox, one of the constructing engineers of the Iowa Engineering Co., of Clinton, Ia., is now making a tour through the South and Mexico.

Capt. J. C. Ayres, Ordnance Department, U. S. A., has been ordered to Sea Girt, N. J., on business pertaining to the construction of a sea coast battery.

Mr. James E. Miller, engineer of the Siemens & Halske Electric Works, of Chicago, Ill., was married Nov. 27 to Miss Katharine Saxton, of Washington, D. C.

Mr. Jos. H. Thompson, Assistant Superintendent of the Western Division of the Southern Pacific Ry., has been appointed Superintendent of Terminals at Oakland, Cal.

Mr. A. J. Earling, General Manager of the Chicago, Milwaukee & St. Paul Ry., has been made Second Vice-President, retaining charge of the operating department.

Mr. D. O'Leary, Superintendent of Bridges and Buildings and Roadmaster of the Keokuk & Western R. R., with office at Centerville, Ia., has been made General Roadmaster.

Mr. John Canaday, a contractor on the Washington & Great Falls R. R., was killed near Rock Springs, Md., Dec. 7, by the explosion of a dynamite cartridge, which he was thawing.

Mr. Frederick O. Baker, railway contractor, died at Fort Scott, Kan., Dec. 4. He built the Wichita & Western R. R., and several roads in Alabama, Missouri and Kansas.

Mr. Wm. W. Wilson, General Manager of the Houston City Street Ry., has been appointed General Manager of the Kansas City, Beaumont & Texas R. R., with headquarters at Beaumont, Tex.

Mr. Desmond Fitz Gerald, M. Am. Soc. C. E., Resident Engineer for the Additional Supply, Boston Water-Works, delivered a lecture on "The Water Supply of Boston," at Willard's Hall, Washington, D. C., Dec. 11.

Mr. James E. Duffy, of Chicago, who was contractor for several large buildings in Chicago, and superintended the construction of the Rookery, Pullman, Great Northern, Leiter and Stock Exchange buildings, died on Dec. 6.

Mr. John J. Shipperd, of Cleveland, O., is at the head of the Consolidated Electric Ry. Co., which has acquired the railways of Fort Wayne, Ind. The company proposes to extend the lines and purchase additional equipment.

Mr. W. T. Carley, formerly Superintendent of the Chattanooga & Lookout Mountain Ry., has been appointed Chief Engineer of the Tennessee Central Ry., with office at Rockwood, Tenn. The road is now under construction.

Mr. Henry A. Hayden, who was connected with the engineering department of the Michigan Central R. R. during the construction of the road, and afterwards engaged in the milling business, died at Jackson, Mich., Dec. 4, at the age of 78.

Maj. A. H. Swanson, formerly General Transportation Manager of the Houston & Texas Central Ry., and later Receiver of the St. Louis Southwestern Ry., has been appointed Manager of the Whitney Iron Works, of New Orleans, La.

Mr. Enoch Robinson, Superintendent of the Old Colony Iron Works, at East Taunton, Mass., died at Taunton Dec. 15, at the age of 87. He was foreman in the forging department of the Bridgewater Iron Works, which made the axles for the cars of the old Quincy granite quarry railway.

Mr. Samuel G. Lewis, at one time controller of the Pennsylvania R. R., died at Philadelphia, Pa., Dec. 9. He entered the accounting department of the Pennsylvania R. R. in 1853, and was successively Assistant Auditor, Auditor and Controller, which position was created with him. He resigned in 1874.

Mr. A. C. Bird, who has been appointed General Traffic Manager of the Chicago, Milwaukee & St. Paul Ry., has resigned his position as chairman of the Trunk Line Committee, and Mr. J. M. Johnson, General Freight Agent of the Chicago, Rock Island & Pacific Ry., has been elected to fill the vacancy.

Mr. W. H. Stevenson, of Boston, Mass., has been appointed Receiver of the Lancaster & Hamden Ry. Co., of Ohio. He was at one time Division Superintendent of the New York, New Haven & Hartford R. R., and Vice-President and General Manager of the Housatonic R. R., and has been connected with a number of New England railways.

Col. Geo. E. Waring, M. I. C. E., Commissioner of Street Cleaning, and Alexander Potter, Assoc. M. Am. Soc. C. E., delivered addresses on "Country House Sewerage" at a dinner given at the Metropolitan Club Dec. 17 by the New York Farmers, which is an association including Chauncey M. Depew, J. Pierpont Morgan and other owners of country houses.

Capt. W. L. Fisk, Corps of Engineers, U. S. A., has been placed in temporary charge of the river and harbor works in the vicinity of Portland, Ore., and also ordered to duty as Engineer of the Thirteenth Lighthouse District, relieving Maj. J. C. Post, who is transferred to duty at Detroit, Mich., taking the post made vacant by the death of Gen. O. M. Poe.

Mr. T. H. McKenzie, M. Am. Soc. C. E., of Southington, Conn., has opened an office in the Ballerstein Building, at Hartford, Conn. He has also a branch office at Bristol, where he is engaged in carrying out a sewerage system and sewage purification plant. He is a member of the State Board of Civil Engineers and the engineer member of the State Board of Health.

The following appointments on the reorganized Erie R. R. are announced: C. R. Fitch, General Superintendent, Erie Railroad Division; A. M. Tucker, General Manager, New York, Pennsylvania & Ohio Railroad; A. E. Mitchell, Superintendent of Motive Power; W. Lavery, Assistant Superintendent of Motive Power; C. W. Buchholz, Chief Engineer; A. Mordecai, Assistant Chief Engineer.

Mr. Frederic B. Close, C. E., has been engaged by the Chicago Heights Land Association as engineer in charge of all improvements at Chicago Heights, Ill., a suburb of Chicago, and to look after the general interests of the association. He formerly carried on a general practice in civil and mining engineering under the firm name of F. B. Close & Co., with headquarters at Hancock, Mich., and will continue to practice as a consulting engineer on municipal work in connection with the above duties.

Mr. Wm. Howard White, M. Am. Soc. C. E., died at his home in Redlands, Cal., Dec. 11. He was born in 1847, and was at one time Assistant Chief Engineer of the Chicago, Burlington & Quincy R. R., and later Chief Engineer of the New York & New England R. R. In 1887 he was for a time editor of the "Railroad Gazette." Among his contributions to the "Transactions of the American Society of Civil Engineers" were papers in some of the early volumes of the society on European engineering practice. Failure of health some years ago obliged him to take up his residence in southern California.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Dec. 11. Quarterly meeting at Boston, Mass. "Operation of a Pumping Plant by Electricity," by Chas. A. Hague. Secy., J. C. Whitney, Newton, Mass.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Dec. 19. Secy., C. H. McLeod, Montreal.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Dec. 19. Secy., D. Carhart, Carnegie Library, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
Dec. 19. Secy., J. F. Wilson, Odd Fellows' Temple.
NEW YORK RAILROAD CLUB.
Dec. 19. Secy., John A. Hill, 256 Broadway, New York.
ENGINEERS' CLUB OF COLUMBUS, O.
Dec. 21. Secy., David Buel.
ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 21. Secy., L. F. Rondinella, 1122 Girard St.
WISCONSIN POLYTECHNIC SOCIETY.
Dec. 24. Secy. W. K. Means, Loan & Trust Bldg., Milwaukee.
ENGINEERING ASSOCIATION OF THE SOUTH.
Dec. 26. Secy., Lucius P. Brown, Nashville, Tenn.
INDIANAPOLIS ENGINEERING CLUB.
Dec. 28. Secy., C. C. Brown.
WESTERN SOCIETY OF ENGINEERS.
Jan. 1. Secy., Chas. J. Roney, Monadnock Block, Chicago.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Jan. 3. Secy. O. H. Von Geldern, 819 Market St., San Francisco.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Jan. 6. Secy., G. L. Annan, City Engineer's Office.
ENGINEERING SOCIETY OF WESTERN NEW YORK.
Jan. 6. Secy., Geo. R. Sikes, 122 Pearl St., Buffalo, N. Y.
INDIANA ENGINEERING SOCIETY.
Jan. 7, 8, 9. Annual meeting at Indianapolis. Secy., J. F. O'Brien, Cloverdale, Ind.
COLUMBIAN ENGINEERING SOCIETY.
Jan. 7. Secy., W. F. Hart, University Bldg., 15th and H Sts. N. W., Washington, D. C.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Jan. 8. "Cost of Sewer Construction at Denver, Colo.," by W. W. Follett. Secy., C. W. Hunt, 127 E. 23d St., New York.
ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
Jan. 9. Secy., Jas. K. Zollinger, Norton Building.
MONTANA SOCIETY OF CIVIL ENGINEERS.
Jan. 11. Secy., Forrest J. Smith, Denver Block, Helena.
CENTRAL RAILWAY CLUB.
Jan. 10. Secy., H. D. Vought, "Courier" Office, Buffalo, N. Y.
ENGINEERS' CLUB OF KANSAS CITY.
Jan. 13. Secy., F. W. Tuttle, Baird Building.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Jan. 14. Secy., F. A. Coburn, Case Library Building.
DENVER SOCIETY OF CIVIL ENGINEERS.
Jan. 14. Secy., H. Breen, 36 Jacobson Block.
NORTHWEST RAILWAY CLUB.
Jan. 14. Secy., G. A. Seley, 80 Metropolitan Block, St. Paul, Minn.
NORTHWESTERN SOCIETY OF ENGINEERS.
Jan. 14. D. W. McMorris, Burke Bldg., Seattle, Wash.
ENGINEERS' CLUB OF ST. LOUIS.
Jan. 15 Jan. 15. Secy., W. H. Bryan, Turner Block.
ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Jan. 15. Secy., F. Van Vleck, Los Angeles, Cal.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Jan. 15. Secy., J. A. Pilcher, Roanoke, Va.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Jan. 15. Secy., S. E. Tinkham, City Hall.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Jan. 15. Secy., R. W. Pope, 26 Cortlandt St., New York.
NEW ENGLAND RAILROAD CLUB.
Jan. 15. Secy., F. M. Curtis, P.O. Box 1576, Boston, Mass.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Jan. 16. Secy., F. A. Charlot, Macon, Ga.
ENGINEERS' CLUB OF MINNEAPOLIS.
Jan. 20. Secy., E. Nexon, Kasota Block.
WESTERN RAILWAY CLUB.
Jan. 21. Secy., W. D. Crosman, Owings Bldg., Chicago.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Mar. 13. Secy., D. W. Meeker, St. Paul, Minn.

CIVIL ENGINEERS' CLUB OF CLEVELAND.—At the meeting on Dec. 10 Mr. George De Leval read an interesting paper on "Crank and Flywheel versus Direct-Compensating Pumping Engines." F. A. Coburn, Secy.

NEW ENGLAND WATER-WORKS ASSOCIATION.—The quarterly meeting was held at Boston on Dec. 11. A paper by Mr. Chas. A. Hague, M. Am. Soc. M. E., on the subject "Operation of a Pumping Plant by Electricity," was read by a member of the Association.

INDIANA ENGINEERING SOCIETY.—The sixteenth annual meeting will be held in the State House, at Indianapolis, Ind., Jan. 7, 8 and 9, 1896, and the Indiana Highway Improvement Association will meet with the Society on Jan. 8. J. F. O'Brien, Secy., Cloverdale, Ind.

WESTERN RAILWAY CLUB.—The regular meeting of the Club was held at the Auditorium Hotel, Dec. 17, 1895. The discussion was on "Air-Brake Equipment on Freight Cars," and "Piece-Work in Car Shops." The paper of the day was on "Locomotive Service," by Mr. J. H. McConnell, Superintendent of Motive Power, Union Pacific Ry.

NORTHWEST RAILROAD CLUB.—At the meeting on Dec. 10, Mr. H. H. Vaughan (Great Northern Ry.) read a paper on "The Hauling Capacity of Locomotives," and a discussion on locomotive service was opened by Mr. G. Seeley (Chicago Great Western Ry.). A paper on "Hard Times" was also read by Mr. Wm. McIntosh (Chicago, St. Paul, Minneapolis & Omaha Ry.).

ENGINEERS' CLUB OF ST. LOUIS.—At the annual meeting, held Dec. 4, Mr. C. H. Sharman read a

paper prepared by Mr. R. J. McCarthy, of Kansas City, on the subject of smoke prevention, which paper had already been read by the author before the Engineers' Club of Kansas City. It was an able and exhaustive presentation of the subject, and was discussed at some length. Prof. J. H. Kinealy exhibited a new form of draft gage, which remedied many of the troubles incident to the ordinary forms of apparatus.

Wm. H. Bryan, Secy.

ENGINEERS' CLUB OF PHILADELPHIA.—At the meeting on Dec. 7 Mr. John Birkinbine presented a paper upon "Notable Engineering Achievements in the Great Lake Region," illustrated by lantern views of mining operations, ore-shipping docks, steamers, unloading apparatus, etc. He said that freight was carried on these lakes an average distance of over 800 miles for slightly less than 1 mill per ton-mile. The Sault Ste. Marie lock, Chicago drainage canal, river-flushing pump at Milwaukee, and the St. Clair tunnel were among the works in the paper.

L. F. Rondinella, Secy.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—At the meeting of Dec. 2 no regular program was prepared, but several members volunteered interesting information. Mr. Davenport described the three classes of earth slides which occur along the Red River of the North. The most remarkable have taken place two or three years after great floods (such as those of 1882 and 1893), when suddenly vast masses of the banks, several hundred feet wide, and from 30 to 50 ft. high, sink abruptly, and from 150,000 to 250,000 yards of the deeply-underlying clay strata slide into the river, there being no horizontal movement of the upper mass. Mr. Hilgard mentioned the fact that a pier of the N. P. R. R. bridge, at Bismark, slid 27 ins. out of position, presumably on a bed of clay moistened by leakage from the city reservoir. Mr. Estabrook stated that a saving of about 20% has been effected by substituting a triple for a double-expansion engine at the Washburn-Crosby flour mills in Minneapolis.

C. L. Annan, Secy.

WESTERN SOCIETY OF ENGINEERS.—At the meeting of the Society, held Dec. 19, a paper on the "Engineering Consequences of the Waterway Conventions at Cleveland and Vicksburg, 1895," was read by Mr. Thos. T. Johnston, Assistant Chief Engineer, Sanitary District of Chicago.

The Society has inaugurated a series of "topical discussions," which are intended to embrace various engineering subjects, and to be held periodically. The first subject selected is "Hydraulic Cements," and the members are asked to submit written discussions, with replies to the following questions in view:

(1) What are the relative qualities of the several Portland and natural cements at present in general use?

(2) To what extent is the testing of cements useful in connection with various classes of work?

(3) What nature of testing is suitable?

(4) What are the essential points which should be covered in specifications as to testing cements?

(5) What is the influence of the amount of water used in forming pastes and mortar?

(6) How are the several cement mortars affected by cold, both in laboratory and in practical work?

(7) How are mortars affected by tempering?

(8) What should specifications require as to mortar and mortar mixing?

(9) How are cement mortars affected by different qualities of sand?

(10) To what extent can cement mortar plasters be relied upon to adhere to cement mortar concretes, especially when Portland cement is used for plaster, and natural cement for concrete?

(11) Discuss any other features as to use and quality of hydraulic or natural cements.

These written discussions are to be submitted by Jan. 2, 1896, printed and distributed, and a meeting of the Society appointed for an oral discussion.

ROADMASTERS' ASSOCIATION OF AMERICA.—At a meeting of the Executive Committee held in Chicago, Dec. 9, the following subjects were selected for reports and committees appointed to report upon them at the next convention of the Association:

1. "Tie Plates; Their Benefits and Results Obtained from their Use. Will their Use Dispense with the Use of Rail Braces?" Committee: Robert Black, Manhattan Elevated; A. Morrison, Lehigh Valley; J. B. Moll, Chicago, Milwaukee & St. Paul; Geo. W. Light, Detroit Union Terminal Station; R. Hyland, Fitchburg; J. A. Heckler, Denver & Rio Grande.

2. "Best Way of Protecting Facing-Point Switches." Committee: W. D. Otis, New York Central & Hudson River; R. Caffrey, Lehigh Valley; A. S. Weston, New York Central & Hudson River; E. J. Shannessey, Grand Rapids & Indiana; C. Markham, Chicago & West Michigan.

3. "Elevation for Each Degree of Curve for Speed of 10, 20, 30, 40, 50 and 60 Miles per Hour, and the Advisability of Using Easement Curves." Committee: Garret Davis, Burlington, Cedar Rapids & Northern; I. O. Walker, Paducah, Tennessee & Alabama; H. G. Hetzler, Chicago, Burlington & Quincy; John Doyle, Chicago & West Michigan; Geo. W. Merrell, Chicago, Milwaukee & St. Paul.

4. "Latest Improvements in Frogs and Switches." Committee: J. A. Lahey, Chicago & Northern Pacific; A. S. Lippert, New York Central & Hudson River; G. D. Gifford, New York Central & Hudson River; A. Philbrick, Illinois Central; P. Madden, Chicago, Milwaukee & St. Paul.

5. "Rail Joints." Committee: C. F. Blue, Illinois Central; J. B. Moll, Chicago, Milwaukee & St. Paul; J. W. Wright, Chicago & Northwestern; Geo. M. Brown, Flint & Pere Marquette; William Brandt, Chicago & Northwestern.

6. "Ballast; What is the Best Kind of Ballast? What is the Best Method of Handling Ballast? What is the Best Cross-Section for Each Kind of Ballast, Both as to Roadbed and Ballast?" Committee: W. H. Courtney, Lake Shore & Michigan Southern; T. Hickey, Michigan Central; W. D. Otis, New York Central & Hudson River; W. H. Burns, New York Central & Hudson River; F. R. Doty, Illinois Central.

Besides these reports the programme arranged by the Executive Committee provides for papers on the following subjects:

"The Relation Between the Rail and the Load it is Now Carrying," by John Doyle, Chicago & West Michigan; and "Ditching," by J. W. Meade, Atchison, Topeka & Santa Fe.

The Committee on Arrangements for the next annual convention to be held at Niagara Falls, N. Y., consists of W. D. Otis, A. S. Weston, T. Hickey, W. E. Emery and R. Caffrey.

The secretary of the Association is J. B. Dickson, Sterling, Ill.

RAILWAY SIGNALING CLUB.—A regular meeting was held at the Great Northern Hotel, Chicago, Dec. 10. The subject for discussion was the paper by Mr. W. H. Elliott on electric locking presented at its November meeting, and which was printed in the Engineering News of Dec. 5. Mr. E. D. Wileman (L. S. & M. S.) opened the discussion by quoting a case of a derailment which had recently occurred on that road, in which a derailing switch had been deliberately thrown under a train. This was possible on account of the location of the switch upon a curve which was so wide of gage that the treads of the wheels uncovered the detector bar which happened to be upon the inside rail of the curve. He uses this as an illustration of the desirability of electric locking, which would prevent the movement of the lever as long as the track circuit was covered by the train.

Mr. H. D. Miles (Mich. Cent.) thought Mr. Elliott's circuits to be applicable in cases of simple interlocking plants, or such as were shown in the illustrations accompanying the paper, but he considered the number of track insulations required a serious objection to th's arrangement in larger plants, and suggested the use of track instruments instead. One of these could be placed beyond the distant signal for the application of the circuits operated by the train, and the releasing instrument could be placed entirely beyond the limits of the plant in the other direction. After considerable discussion the opinion seemed to prevail that track circuits, owing to their property of detecting the presence of a single pair of wheels, were better adapted to this work.

Mr. E. Moore, Mechanical Engineer for the Commissioner of Railroads of the State of Michigan, quoted a number of cases of derailment which had occurred in that state on account of switches having been changed after the corresponding signals had been cleared. He considered electric locking very desirable, and expressed a conviction that unless derails are electrically locked the distant signals governing routes over them should be fixed in position and used only to signify to the engineer that he was approaching an interlocking plant. He thought this additional protection to be a necessity, and considered that its application would be a benefit to all concerned. He seemed to be very nearly ready to recommend that electric locking should be required in connection with all of the interlocking works put in in Michigan.

This discussion was followed by a paper by Mr. W. W. Salmon, General Agent of the Hall Signal Co., upon the subject of "Automatic Switch Indicators," which is published on another page of this issue. The rest of the evening was devoted to a topical discussion, which was of unusual interest. The subject of the maintenance of track in connection with interlocking plants was introduced by Mr. H. M. Sperry (National Switch & Signal Co.), who exhibited a sketch of a section through the stock and point rail of a switch located on a curve of which the stock rail had worn so badly upon the head that a derailment occurred on account of a flange climbing the point when the switch was thrown for the siding. The turnout was upon the inside of the curve, and the trouble occurred when the switches were thrown off the main line.

Mr. W. McC. Grafton (Pennsylvania Lines, west of Pittsburg) considered the signal maintainers to be partly at fault and equally so with the track derailment, as the switch should not be allowed to get into such a dangerous condition. He also showed that a sharp flange might be expected to give trouble in such cases, and stated that it would be easy to place the responsibility upon the mechanical department if the track were properly kept up. A sharp flange would be likely to cause a derailment at such a switch, even if the latter were not badly worn. He spoke of a case in his experience in which the stock rail of a switch had been forced out away from the point, which amounted to an open switch. For protection from such difficulties at interlocking plants he had adopted a lock attachment which was so rigidly secured to the stock rail to force the lock to follow the motions of the rail. In this way the point and stock rails were locked securely together, and no space could intervene between them. A brief discussion took place on pipe connections for distant signals, and Mr. Grafton said that whereas several years ago his road had discarded distant signals operated from the tower, that now they were being used again, but that they were all being connected up with pipe lines to the towers.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Dec. 20.	Brick sewers (21,200 ft.),	St. Louis, Mo.	Dec. 12
Dec. 20.	Pipe sewers (94,160 ft.),	St. Louis, Mo.	Dec. 12
Dec. 20.	Recreation buildings,	Binghamton, N. Y.	Dec. 12
Dec. 20.	Fireproof vault,	Brooklyn, N. Y.	Dec. 12
Dec. 20.	Canal (30 miles),	Baltimore, Md.	Nov. 28
	Advertised, Eng. News, Nov. 28.		
Dec. 20.	Electric lighting,	Medina, N. Y.	Dec. 5
Dec. 20.	Cast iron pipe,	Providence, R. I.	Dec. 19
Dec. 20.	Flagging,	Brooklyn, N. Y.	Dec. 19
Dec. 21.	Connecting boilers, etc.,	Buffalo, N. Y.	Dec. 12
Dec. 21.	Railway grading,	Anderson, Ind.	Dec. 12
Dec. 21.	Ditch (112,000 cu. yds.),	Champaign, Ill.	Dec. 12
Dec. 21.	Stone, to be placed at	Plaquemine, Fla.	Dec. 12
Dec. 21.	School building,	Buffalo, N. Y.	Dec. 12
Dec. 21.	Road work,	Stamford, Conn.	Dec. 12
Dec. 21.	Improving streets,	Mansfield, O.	Dec. 12
Dec. 21.	Sewers, etc. (22 streets),	New York, N.Y.	Dec. 12
Dec. 21.	Steel & ironwork for U. S. bldg.,	N. Y.	Nov. 28
Dec. 21.	Electric light plant,	Cincinnati, O.	Dec. 19
Dec. 23.	Storehouse improvements,	Binghamton.	Dec. 12
Dec. 23.	Electric lighting,	Philadelphia, Pa.	Dec. 12
Dec. 23.	Irrigation bonds,	Ogallala, Neb.	Dec. 12
Dec. 23.	U. S. public building work,	Buffalo, N.Y.	Dec. 12
Dec. 23.	Plans for court house,	Milwaukee, Wis.	Dec. 12
Dec. 23.	Court house,	Harrisonville, Mo.	Dec. 12
Dec. 23.	Fire apparatus,	New York, N. Y.	Dec. 12
Dec. 23.	Water wks. extensions,	Riverside, Ill.	Dec. 12
	Advertised, Eng. News, Dec. 12.		
Dec. 23.	U. S. public building work,	Buffalo, N. Y.	Dec. 5
	Advertised, Eng. News, Dec. 5 and 12.		
Dec. 23.	Library building,	Hoboken, N. J.	Dec. 5
Dec. 23.	Tunnel (6,300 ft.),	Colorado Springs, Colo.	Dec. 5
	Advertised, Eng. News, Nov. 21 to Dec. 19.		
Dec. 23.	Heating & ventilating,	Canton, O.	Nov. 28
Dec. 23.	Pipe sewers,	Syracuse, N. Y.	Dec. 19
Dec. 23.	Paving,	Syracuse, N. Y.	Dec. 19
Dec. 23.	Garbage disposal,	Philadelphia, Pa.	Dec. 19
Dec. 23.	Heating and ventilating,	Canton, O.	Dec. 19
Dec. 23.	Asphalt paving,	Brooklyn, N. Y.	Dec. 19
Dec. 23.	Sewer plans,	Red Bank, N. J.	Dec. 19
Dec. 23.	Electric wiring,	Walton, N. Y.	Dec. 19
Dec. 23.	Street cleaning, etc.,	Philadelphia, Pa.	Dec. 19
Dec. 23.	Fire apparatus,	Philadelphia, Pa.	Dec. 19
Dec. 23.	Drainage ditch,	Charlotte, Mich.	Dec. 19
Dec. 24.	Lumber for canal repairs,	Albany, N. Y.	Dec. 12
Dec. 24.	Macadamizing,	Kansas City, Mo.	Dec. 19
Dec. 24.	Electric wiring, etc.,	Brooklyn, N. Y.	Dec. 19
Dec. 24.	Heating, etc.,	New York, N. Y.	Dec. 19
Dec. 26.	Brick sewer (1,900 ft.),	Elizabeth, N. J.	Dec. 12
Dec. 26.	Water supply,	Ft. Hall Ind. Res. Idaho.	Nov. 28
Dec. 26.	Removal of wreck,	Boston, Mass.	Dec. 5
Dec. 26.	Breakwater (200 ft.),	Agate Bay, Minn.	Dec. 5
Dec. 26.	Paving bonds ($15,000),	Westwood, O.	Dec. 5
Dec. 26.	Electric light station,	London, O.	Dec. 19
Dec. 26.	Heating, etc.,	New York, N. Y.	Dec. 19
Dec. 26.	Chemical fire engines, etc.,	New York.	Dec. 19
Dec. 27.	Electric light poles (20)),	Denver, Colo.	Dec. 12
Dec. 27.	Public lighting,	Elizabeth, N. J.	Dec. 12
Dec. 27.	48-in. cast iron pipe,	Boston, Mass.	Dec. 12
	Advertised, Eng. News, Dec. 12 and 19.		
Dec. 27.	Lamps (750),	New York, N. Y.	Dec. 5
Dec. 27.	Lumber, etc.,	Chicago, Ill.	Dec. 19
Dec. 27.	Granite block paving,	Brooklyn, N. Y.	Dec. 19
Dec. 27.	Repairing sewers, etc.,	Philadelphia, Pa.	Dec. 19
Dec. 27.	Pipe sewers,	Buffalo, N. Y.	Dec. 19
Dec. 27.	Bridge abutments,	Buffalo, N. Y.	Dec. 19
Dec. 27.	Fire hose (15,000 ft.),	Brooklyn, N. Y.	Dec. 19
Dec. 28.	Water-works system,	Turner, Ill.	Dec. 12
Dec. 28.	Sewer pipe (61,048 ft.),	Arlington, Mass.	Dec. 12
	Advertised, Eng. News, Dec. 12 and 19.		
Dec. 28.	Bridge substructure,	Chicago, Ill.	Dec. 19
Dec. 28.	Test well (3,000 ft.),	Norfolk, Va.	Dec. 19
Dec. 28.	Plumbing, heating, etc.,	Providence, R. I.	Dec. 19
Dec. 28.	Removal of buildings,	Philadelphia, Pa.	Dec. 19
Dec. 28.	Paving,	Baltimore, Md.	Dec. 19
Dec. 28.	Water pipe, etc.,	Hatfield, Mass.	Dec. 19
	Advertised, Eng. News, Dec. 5 to 19.		
Dec. 30.	Sewers,	Piqua, O.	Dec. 12
Dec. 30.	Steel bridges (2),	Denver, Colo.	Dec. 12
Dec. 30.	Stone, Sand Island Light Station,	Ala.	Dec. 12
Dec. 30.	School building,	Norwich, Conn.	Dec. 12
Dec. 30.	Plans for court house,	Wheeling, W. Va.	Dec. 12
Dec. 30.	Heating and ventilating,	Mankato, Minn.	Dec. 12
Dec. 30.	Court house,	Lesueur Center, Minn.	Dec. 19
Dec. 30.	Tank foundations, etc.,	Cincinnati, O.	Dec. 19
Dec. 30.	Paving, etc.,	New York, N. Y.	Dec. 19
Dec. 30.	60-in. steel pipe (1,000 ft.),	Duluth, Minn.	Dec. 19
Dec. 30.	Granite paving, etc.,	Brooklyn, N. Y.	Dec. 19
Dec. 31.	Public lighting,	Davenport, Ia.	Dec. 12

Dec. 31.	Paving,	Cincinnati, O.	Dec. 19
Dec. 31.	Boilers,	Brooklyn, N. Y.	Dec. 19
Jan. 1.	Cast iron pipe,	Lowell, Mass.	Dec. 19
	Advertised, Eng. News, Dec. 19.		
Jan. 2.	Lighthouse work,	Mobile, Ala.	Dec. 12
	Advertised, Eng. News, Dec. 12 and 19.		
Jan. 2.	Plumbing, etc.,	Baton Rouge, La.	Dec. 12
Jan. 2.	Building bonds,	Newark, O.	Dec. 12
Jan. 2.	Garbage crematory,	Dayton, O.	Dec. 5
Jan. 2.	Light station,	Baltimore, Md.	Dec. 19
Jan. 6.	Bridge,	Astoria, Ore.	Nov. 21
Jan. 3.	Paving,	Camden, N. J.	Dec. 19
Jan. 6.	Water-works,	Lockport, Ill.	Dec. 19
Jan. 6.	Water pipes (16 sts.),	Des Plaines, Ill.	Dec. 19
Jan. 6.	Bridges (2),	Leavenworth, Kan.	Dec. 19
Jan. 6.	Irrigation bonds ($100,000),	Sargent, Neb.	Dec. 19
Jan. 6.	Water-works,	Greenwood, Miss.	Dec. 19
Jan. 7.	Street sweeper,	Riverside, Cal.	Dec. 19
	Advertised, Eng. News, Dec. 19 and 26.		
Jan. 7.	Lift bridge,	Middletown, O.	Dec. 12
Jan. 7.	Street ry. franchise,	New Orleans, La.	Oct. 17
Jan. 7.	Pumping engine,	Red Wing, Minn.	Nov. 28
Jan. 7.	Dredging,	Collingwood (Ont.) Harbor	Dec. 5
Jan. 7.	Iron bridge,	Annapolis, Md.	Dec. 5
Jan. 7.	Trenching, etc.,	Grand Junction, Colo.	Dec. 19
Jan. 8.	Bridge,	Cheyenne, Wyo.	Dec. 19
Jan. 9.	Electric light plant,	London, O.	Dec. 19
Jan. 10.	Plans for water-works,	Unionville, Mo.	Dec. 12
Jan. 10.	Pumping engine,	Washington, D. C.	Dec. 12
	Advertised, Eng. News, Dec. 12.		
Jan. 10.	Well,	Unionville, Mo.	Dec. 12
	Advertised, Eng. News, Dec. 19.		
Jan. 10.	School building (28 rooms),	Chicago, Ill.	Dec. 19
Jan. 10.	Pumping engine,	Brockton, Mass.	Dec. 19
Jan. 10.	Mfg. plant buildings,	Phoenixville, Pa.	Dec. 19
Jan. 11.	Plans for school bldg.,	Williamsport, Pa.	Dec. 12
Jan. 12.	Steel bridge,	Burlington, Kan.	Dec. 19
Jan. 13.	Plans for court house,	Galveston, Tex.	Nov. 21
Jan. 13.	Memorial hall,	West Point, N. Y.	Dec. 19
	Advertised, Eng. News, Dec. 19 to Jan. 2.		
Jan. 14.	Electric lighting,	Carrollton, Ill.	Dec. 19
Jan. 15.	Electric light bonds,	Miles City, Mont.	Dec. 12
Jan. 15.	Water-works system,	Pomona, Cal.	Dec. 19
	Advertised, Eng. News, Dec. 19 to Jan. 9.		
Jan. 15.	Stone wing wall,	San Francisco, Cal.	Dec. 19
Jan. 25.	Intercepting sewer,	Washington, D. C.	Dec. 19
	Advertised, Eng. News, Dec. 19 to Jan. 23.		
Jan. 27.	Court house,	Fresno, Cal.	Dec. 19
Mar. 3.	Street railway franchise,	New Orleans.	Dec. 5

RAILWAYS.

East of Chicago.

BOSTON & ALBANY.—At a meeting of the directors Dec. 12 the president was authorized to execute a contract with the city of Newton, Mass., in regard to the abolition of grade crossings. The contract as signed is said to call for a depression of the railway tracks through the city, and the construction of 17 steel bridges; estimated cost, about $3,000,000. Pres., Wm. Bliss, Boston.

CANTON & WOOSTER.—H. A. Kennedy, Pres., Canton, O., writes us that the projected length of this road is 28 miles, of which four miles are constructed. The surveys have been made, as stated in our issue of Dec. 5. Ch. Engr., C. W. Butcher, Canton, O.

CINCINNATI, GEORGETOWN & PORTSMOUTH.—There is a report that this railway will be extended to West Union, O., and a branch built to Batavia, O. Pres., R. Peters, Cincinnati, O.

DUQUESNE BRANCH WEST SIDE BELT.—Incorporated in Pennsylvania, with a capital stock of $100,000, to build a steam railway in Baldwin township, near Broughton postoffice, to Mifflin township, all in Allegheny county. Pres., Jas. D. Callery, Pittsburg.

HUDSON RIVER & WASHINGTON COUNTY MIDLAND.—We are informed that contracts will be awarded soon for constructing this railway, noted Dec. 5. It will be eight miles in length, connecting Greenwich, Middle Falls and other places with Schuylerville, all in New York. The rights of way have been obtained, capital secured, and piers on the Hudson River finished. Pres., Dudley Farlin, 155 W. 66th St., New York; Ch. Engr., Wallace Greenalch; Gen. Man., N. F. Stewart; Secy., Wm. M. Kennedy; Treas., Jas. J. Wells; Vice-Pres., W. N. Sprague, all of Greenwich, N. Y.

INDIANA MINERAL.—A press report from Rushville, Ind., states that the engineers of this company reached that city Dec. 7, having been four months on the line from Dayton, O. The road is intended as a short line between Dayton and Terre Haute. The surveys alone will cost nearly $200,000. E. O. Rice, of St. Louis, who has been chief engineer of several roads, is in charge of the work. R. J. Whitney, of Alton, Ill.; J. H. Bethune and S. W. Burkhard, of St. Louis, are said to be interested.

LAKE SUPERIOR & ISHPEMING.—This road is now in operation from Ishpeming to Marquette, Mich., 17.8 miles. Winston Bros., of Minneapolis, have the contract, and are now at work. The maximum grade is 1.63%, and maximum curvature, 5°. The road is to be completed by Aug. 1, 1896.

LANCASTER & HAMDEN.—The stockholders have voted unanimously to build three new branches to this Ohio road, as follows: From Lancaster to Hadley Junction and Walters; Laurelville to Kingston, and from Ash Cave to Point Pleasant. The road is in a receiver's hands, and has not been operated for some time. Pres., J. G. Reeves, Lancaster, O.

NEW YORK, ONTARIO & WESTERN.—Press reports state that surveys have been made for a new branch from Pecksport, N. Y., to White's Corner, six miles, and that the line will be built early in the spring. Gen. Man., J. E. Childs, 56 Beaver St., New York.

Southern.

DAHLONEGA.—The location of this railway has been made to within 8 miles of the Southern in the direction of Lula, Ga., and Capt. Geo. J. Baldwin, of Dahlonega, Ga., the chief projector, is quoted as stating that grading will be commenced within a few days. The line will extend from Lula Junction, on the Southern, to the chestates pyrites mines, about 7 miles beyond Dahlonega.

PENSACOLA & NORTHWESTERN.—S. N. Van Prang, Pres., Pensacola, Fla., writes us that grading will be commenced the latter part of January, and that he is now ready to receive bids for work on the first 50 miles, on a cash basis, with privilege of 320 miles. This road has been projected for some time, and is intended to extend from Pensacola, Fla., through Demopolis and Eutaw, Ala., to Memphis, Tenn., 440 miles.

Northwest.

ATCHISON, TOPEKA & ST. JOSEPH.—Jas. W. Way, Ch. Engr. Missouri Pacific, writes us that surveys are now being made for this railway, projected from Atchison to St. Joseph, Mo., via Doniphon, Mo., 20 miles. Press reports state that a 2,000-ft. tunnel will be required to secure the desired entrance into Atchison. Pres., B. P. Waggener; Ch. Engr., W. H. Bush, both of Atchison, Kan.

BLACK HILLS.—A convention was held at the Minneapolis Commercial Club last week with a view to securing a direct railway from that city to the Black Hills country. About 40 delegates from South Dakota towns were present. Several plans were discussed, and it is thought that the road will be built at an early date.

CHICAGO, FORT MADISON & DES MOINES.—Press reports state that surveys are being made for an extension of this railway from Ottumwa to Des Moines, Ia. Gen. Man., E. F. Potter, Fort Madison, Ia.

DAKOTA, WYOMING & MISSOURI RIVER.—At a meeting at Rapid City, S. Dak., Dec. 7, a committee was appointed to confer with the projectors of this railway, with a view to its early construction. Wm. T. Coad, of Rapid City, is interested.

KEOKUK & WESTERN.—This company has purchased the Des Moines & Kansas City, a narrow-gage line extending from Des Moines to Kalnsville, Mo., 112 miles, with valuable terminals at Des Moines and Osceola, Ia., and press reports state that it will at once change the track to standard gage, and probably extend the line to St. Joseph and Kansas City.

OTTUMWA & EDDYVILLE.—J. M. Kussert, of Eddyville, Ia., writes us that surveys are now being made for this railway from Ottumwa to Chillicothe and Eddyville, 16 miles. The object is to make an outlet from Ottumwa north for the Wabash and Santa Fe and let the Iowa Central & Northwestern in. Local capitalists have the matter in hand.

PEORIA, LACON & NORTHERN.—Organized in Illinois to build a railway from a point opposite Peoria to Spring Valley. It will pass through Spring Bay, which has no railway, connect with the Santa Fe opposite Chillicothe, connect with the Alton at Lacon, giving Lacon a through line; touch Henry across the river, pass through Hennepin, county seat of Putnam county, which has no railway. The Illinois Central will have to build but a few miles to connect with it near Spring Valley, and it will connect with the Chicago & Northwestern at Spring Valley. The line will be about 50 miles long, but its connections are of the utmost importance, and it passes through rich coal fields and productive agricultural country; capital stock, $1,000,000. The incorporators include J. M. McNab, of Palatine, Ill.; R. B. Fort, mayor of Lacon, Ill.; Major George F. Wightman, of Lacon, ex-city engineer of Peoria, who has had considerable experience in railway building; Dr. T. M. McIlvaine and E. C. Howlett, of Peoria, Ill.

Southwest.

EL PASO NORTHERN.—This company has been reorganized and it is thought that the unfinished line between El Paso and White Oaks will be completed at an early date. Pres., L. S. Thorne, Dallas, Tex., who is also general manager of the Texas & Pacific.

MISSOURI, KANSAS & TEXAS.—Press reports state that surveys are being made by J. W. Petheran, Ch. Engr., for a branch from Belton, Tex., to quarries about five miles northwest of the town.

ROCKPORT & NORTHERN.—Organized in Texas to build a railway from Aransas Pass to Smithville, Tex., on the Missouri, Kansas & Texas, a distance of 145 miles; capital stock, $5,000,000.

SANTA FE, OKLAHOMA & WESTERN.—The officers of this company, noted last week as incorporated in Oklahoma, Dec. 7, are as follows: Pres., R. Finley Conover, Perry, Okla.; First Vice-Pres., A. A. Kellogg, Clinton, Mo.; Second Vice-Pres., H. R. Berry, Rushville, Ind.; Secy., John S. Johnson, Perry, Okla.; capital stock, $1,500,000. The road is projected from Sapulpa, Ind. Ter., to Fort Sill, Ind. Ter., and Vernon, Tex.

TEXAS, LOUISIANA & EASTERN.—S. Lazarus, receiver, Sherman, Tex., is quoted as stating that the work of extending the road from its present terminus to Silsbee, Tex., will begin soon, probably during this month.

Rocky Mt. and Pacific.

ELSINORE, POMONA & LOS ANGELES.—Incorporated in California, Dec. 6, to build a standard gage steam railway 57 miles long, from Elsinore to Azusa, Pomona and Lordsburg, all in Los Angeles county; capital stock, $1,500,000, with $60,000 paid in; incorporators, K. H. Wade, G. Holterhoff, Jr., H. C. Whitehead, Los Angeles; James Hill, Elsinore, and N. C. Hudson, South Riverside, Cal.

SILVERTON.—Local papers state that this company has the money in hand for an extension from Ironton to Mineral Point, 15 miles, and that the construction will probably soon be commenced. Gen. Man., M. Liverman, Silverton, Colo.

Foreign.

COSTA RICA.—The Talamanca Railway & Fruit Co., of London, England, proposes to build a pier at Port Vargas, and a railway 10 miles long from that point to its banana plantations of 2,500 acres. Cons. Engr., E. Harry Woods; Secy., J. Carter Hart, London.

STREET AND ELECTRIC RAILWAYS.

ST. JOHNSBURY, VT.—It is stated that a syndicate from Burlington, headed by F. C. Kennedy, of the Military Post St. Ry. Co., has decided to build an electric road here, to be completed by June. The plan is to run through the village and to St. Johnsbury Center, with eventual extensions to Lyndonville and Passumpsic.

BOSTON, MASS.—Press reports state as follows: The new Brookline St. Ry. will be equipped with the electric storage battery system, for heat and light, as well as power. The power will be purchased from the Newton line. The directors of the company are W. H. Lincoln, M. P. Kennard, Geo. F. Bouve, Walter Channing and A. D. Chandler, of Brookline; W. A. Boland, of Lynn, and Samuel M. Jackson, of Newton. The company is capitalized for the present at $80,000, and the shares have been taken at par, $100, by eighteen subscribers. The Storage Battery Co., of Philadelphia, Pa., by its contract will agree to give a satisfactory service for a period of six months, and will put up a forfeit to cover the cost of the plant.

GREENFIELD, MASS.—The Conway Electric St. Ry. Co. has petitioned for permission to extend its road along the bank of the Deerfield River, over which a 400-ft. bridge, to cost about $16,000, will be required. Supt., A. C. Guilford, Conway; Engr., E. E. Davis, Northampton, Mass.

MILLBURY, MASS.—J. A. Courtemanche, of Worcester, Mass., has been awarded the contract for the foundations for the car houses for the Blackstone Valley Electric Ry. Co., and P. J. Casserly, of Spencer, Mass., has been awarded the contract for furnishing and erecting the poles.

MILFORD, MASS.—It is stated that the new power house of the electric railway will be a fireproof brick building, 43×80 ft., with a 75-ft. brick chimney, and will be equipped with two 200-HP. engines. The plans were drawn by E. H. Kitfield, by whom the bids were received Dec. 14.

ROCKPORT, MASS.—The Rockport St. Ry. Co. is to build an electric road six miles long, and also a power house, at once, according to reports. W. B. Ferguson, 53 State St., Boston, is interested.

NEW LONDON, CONN.—The New London St. Ry. Co. has decided, it is said, to build its power house in this city, at an estimated cost of about $50,000.

BALLSTON SPA, N. Y.—A. B. Paine and C. H. Stanton, of New York, representing A. N. Chandler & Co., of Philadelphia, have made an application to the highway commissioners for a franchise to build an electric railway from this village to Rock City Falls.

BROOKLYN, N. Y.—The Brooklyn Bridge, Prospect Park & Eastern Ry. Co. has been incorporated to build an electric road about 45 miles in length in Brooklyn; capital stock, $500,000; directors, A. N. Brady, Albany; J. R. Pettit, Brooklyn; Fred S. Flower, Edward Browne, B. A. Place, W. J. K. Kenny, C. H. Werner, G. M. Curtis, Jr., and W. H. Turner, of New York city. This road, if built, will be a part of the Brooklyn City system.

BUFFALO, N. Y.—The Crosstown St. Ry. Co. has petitioned the board of public works for permission to construct its electric road on 28 streets, which it does not at present occupy.

KINGSTON, N. Y.—It is reported that the Colonial Electric St. Ry., which has been in the hands of receivers, has been purchased for $70,000 by Chas. S. Davison, of New York, representing a committee of the first mortgage bondholders, and that the road will be pushed to completion either under or over the West Shore tracks. It is now being operated on each end of the line.

MEDINA, N. Y.—Capt. Lina Beecher, of Medina, is said to have been awarded the contract for the construction of an electric road from Ridgeway to Crystal Beach. By the terms of the contract Mr. Beecher is to use his system of single-rail with full equipments, this being the same as the road to be constructed from Waterport to Batavia, through Medina.

PORTCHESTER, N. Y.—Portchester Electric Ry. Co. has been incorporated to construct a road about 10 miles in length in Portchester; capital stock, $500,000; directors, Thos. S. Krutz, John E. Bowles, Theodore L. Cuyler, Jr., Chas. P. Bruch, Geo. E. Boucher, Albert E. Beck, David J. Pearsall, and Henry F. Hawkins, all of New York city.

PORT JERVIS, N. Y.—The Port Jervis Electric St. Ry. Co. has been incorporated to operate a road in Port Jervis seven miles in length; capital stock, $70,000; directors, Lafe Pence and Geo. N. McGibbon, New York; S. D. Lake, Gus Elston, J. E. Wickham, J. S. Marsh, and others of Port Jervis.

HACKETTSTOWN, N. J.—It is stated that surveyors are at work upon a route for the proposed trolley line to connect Valley, on the Lehigh Valley R. R., with Lake Hopatcong. This road will be built by the Lehigh Valley R. R. as a competitor of the New Jersey Central's branch, which connects with the main line at High Bridge. The road will be about 25 miles long, and will run through Washington and Hackettstown. The right of way for nearly the whole route has been secured.

HOBOKEN, N. J.—The Hoboken, Jersey City & Rutherford R. R. Co. has petitioned for a franchise for its electric road in this city.

BLOOMSBURG, PA.—Maj. E. C. Hamilton, of Shamokin, Pa.; G. M. Smith, of Philadelphia, Man. Shamokin & Mount Carmel Electric Ry. Co., and J. S. Woods are interested in a projected electric railway between Berwick and this place.

PITTSTON, PA.—The Pittston People's Electric St. Ry. Co. has been incorporated to build a road to Avoca; capital stock, $50,000; Pres., Jos. H. Glennan, of West Pittston, Pa.

CHARLESTON, W. VA.—It is stated that Vandergraff & Jacobs, of Philadelphia, Pa., have been awarded the contract for the construction of the Charleston St. Ry., work on which is to be begun at once.

PENSACOLA, FLA.—The council has been petitioned by Sterritt Tate and others for a franchise for an electric railway on the principal streets of this city.

ALGIERS, LA.—An electric road is to be built from this place to Gretna, according to reports.

SCRANTON, MISS.—Martin Turnbull has petitioned the board of aldermen of Scranton for the right of way for a street railway between East Pascagoula and Scranton. The board has postponed action until a special committee, composed of S. R. Thompson and C. E. Chidsey has examined the proposed route and report at a special meeting to be called for the purpose. He was, however, granted the right of way by the town of East Pascagoula.

AKRON, O.—The Akron St. Ry. & Illuminating Co. has been incorporated with a capital stock of $1,500,000. This company will succeed the Akron St. Ry. Co. and the Akron General Electrical Co. Incorporators: J. B. Clews, of Henry Clews & Co., and E. C. Gibson, of New York, N. Y.; J. A. Long, F. A. Seiberling and Ira M. M. Miller, of Akron.——The county commissioners have granted Thos. F. Walch, Man. and Supt. Akron & Cuyahoga Falls Rapid Transit Co., a franchise for an electric railway from Barberton to Hametown. The pro-

posed line will extend to Wadsworth in Wayne county. Work will be commenced immediately, according to reports.

NEW PHILADELPHIA, O.—Maj. C. E. Milchener, of New Philadelphia, has been granted a franchise by the council for an electric road to Urichsville, according to reports.

SPRINGFIELD, O.—O. S. Kelly and S. L. Nelson, of Springfield, have petitioned for permission to construct an electric railway on Lagonda Ave. on which to experiment with a newly invented underground electric system.

TOLEDO, O.—The Toledo Traction Co. is reported as having awarded a contract to Cramp & Son, of Philadelphia, Pa., for four engines of 1,000 HP. each for its power house. Pres., A. E. Lang.

GOSHEN, IND.—The superintendent of the electric railway company is preparing plans for a temporary power house at Elkhart, and also a power house at Goshen.

MADISON, IND.—Arrangements are being made by Thos. J. Ryan for R. T. McDonald, Gen. Man. Fort Wayne Electric Light Co., Fort Wayne, for an electric railway in this place.

SOUTH BEND, IND.—The South Bend St. Ry. Co. has been incorporated, with a capital stock of $300,000; directors, J. Ben. Birdsell, F. C. Nippold, A. L. Brick, W. A. Funk and James McM. Smith.

CHICAGO, ILL.—Local papers state that Chas. T. Yerkes proposes to equip the cable railways on the north side with the trolley system. The ordinance authorizing such a change has been prepared, and will soon be introduced in the council.

DANVILLE, ILL.—Arrangements are being made for the construction of the proposed electric road, 35 miles long, from Danville to Paxton and Joliet, Ill. J. K. Butt and J. W. Layne, of Potomac, Ill., are interested.

ST. LOUIS, MO.—The Central Ry. Co. has been incorporated to operate a street railway; capital stock, $2,000, $1,000 of which is paid in. Wm. S. Long and Albert Blair are interested.

TACOMA, WASH.—Councilman P. D. Norton is reported as having introduced an ordinance in the council granting a franchise to the Seattle, Tacoma & Portland Ry. Co. for its proposed electric road from the tide flats at the edge of the Puyallup Reservation to Cliff Ave. and South 12th St. The road is to be built by May 31, 1897.

SACRAMENTO, CAL.—The Sacramento, Fair Oaks & Orange Vale Electric Ry. Co. has secured the right of way for its road to the American River. Pres., L. T. Hatfield; Geo. B. Katzenstein, Man. Orange Vale Colonization Co., is also interested.

SAN FRANCISCO, CAL.—The Electric Ry. Hill-Cable Co. has been incorporated with a capital stock of $1,000,000, to build a cable or electric railway; incorporators, N. W. Griswold, W. H. Birch, John L. Boone and Fred C. Hart, of San Francisco.

BROCKVILLE, ONT.—The Brockville Electric St. Ry. Co., Ltd., has been incorporated with a capital stock of $200,000 by W. H. Comstock, W. A. Gilmore, C. A. Cossitt, G. N. Booth and others, all of Brockville.

ST. CATHARINES, ONT.—The Lincoln St. Ry. Traction & Light Co., Ltd., has been incorporated with a capital stock of $90,000 to build an electric railway in St. Catharines and not further than 1½ miles out from the town limits, and to distribute electricity for light, heat and power. R. H. Hill, H. A. King, of Toronto; J. S. Campbell, Dr. L. S. Oille, and George E. Patterson, of St. Catharines.

ELECTRIC LIGHT AND POWER.

BATH, N. Y.—James H. Paul and Wm. Walker, of Carbondale, Pa., are reported to have petitioned the village board for a 45-year franchise, as it is their intention to purchase the plant of the Bath Electric Light & Power Co. and make a number of additions.

BROOKLYN, N. Y.—Bids are asked until Dec. 24 for furnishing electric light fixtures and wiring the municipal building. Alfred T. White, Comr. Cy. Wks.

NEW ROCHELLE, N. Y.—A committee has been appointed to consider the feasibility of constructing an electric light plant.

ROCKVILLE CENTRE, N. Y.—W. H. Connell, Village Clk., writes us that a company has been granted a conditional consent to erect poles and string wires through the village. The same company is to furnish light and power to Hempstead.

WALTON, N. Y.—Bids are asked until Dec. 23 for electric wiring the state armory building at Walton. State Arch., I. G. Perry, Albany or Walton; Edwin A. McAlpin, Adj.-Gen., Albany.

JERSEY CITY, N. J.—It is reported that the People's Electric Light Co., of Newark, has been awarded a contract to furnish this city with 340 arc lights at $90 per lamp per year. A contract for 300 arc lights has also been awarded to the Hudson County Electric Light Co.

MAUCH CHUNK, PA.—It is stated that East Mauch Chunk his decided to build a $15,000 electric light plant.

READING, PA.—Edward Chamberlain, Cy. Engr., writes us that the electric light committee is now preparing a report for the councils on a municipal plant.

RIDLEY PARK, PA.—Frank R. Savidge, R. S. Pomeroy, Charles G. Darrach, Job Smith, Wendell P. Anthony and Henry H. Taylor are the incorporators of a new electric light company, according to reports.

GREENVILLE, N. C.—It is stated that the Greenville Lumber Co. has been granted permission by the council to put in an electric plant for lighting the entire city.

HENNETTA, N. C.—The Hennetta Cotton Mill No. 2, now about completed, will put in an electric plant of 1,000 lights.

KITTRELL, N. C.—A new winter resort hotel, built at this place by Boston parties and now nearly completed, will be equipped with an electric light plant. Allen & Cram, of Raleigh, N. C., have the contract for putting in the plumbing, etc., and can furnish particulars about the electric light arrangements, or, address Oscar Blacknall, Kittrell, N. C.

UNION, S. C.—The residents have petitioned the council for an election to vote on the question of issuing $40,000 in bonds for an electric light plant and water-works. T. C. Duncan, Chn. Com.; L. S. Young, Town Clk.

LEXINGTON, KY.—H. T. Duncan, Mayor, is reported to have been directed by the committee to advertise for bids for constructing an electric light plant. Bids were received Oct. 30 for lighting the city, as advertised in Engineering News, but have not yet been acted upon by the council.

CINCINNATI, O.—Bids are asked until Dec. 21 for furnishing and installing an engine and dynamo for the electric light plant in connection with the public library building. Engr., Thos. G. Smith, 11 Hammond Bldg., Cincinnati.

GREENWICH, O.—It is stated that plans and specifications have been prepared for the construction of a light plant and water-works.

LONDON, O.—Bids are asked until Dec. 26 for constructing an electric light station, and until Jan. 9 for the necessary incandescent and arc-lighting dynamos, and electrical machinery for the plant. Engr. Frank B. Rae, 134 Monroe St., Chicago, Ill.; Wm. A. Neil, Mayor; John D. Redden, Village Clk.

ST. MARY'S, O.—The city is to issue $12,000 in bonds for an electric light plant, according to reports.

UNION CITY, IND.—We are informed that the Union City Wheel Co. has completed its brick building, where wheels for light vehicles will be manufactured. It is probable that an electric light plant will be wanted. Pres., S. R. Bell, Union City.

LANSING, MICH.—The Howell Mfg. Co., local papers say, has purchased the Leadley Dam, and will at once erect a brick power house, where it is proposed to generate 2,000 HP.

WYANDOTTE, MICH.—J. H. Bishop & Co., of Wyandotte, have awarded a contract to the Western Electric Co., of Chicago, Ill., for a 420 incandescent light plant. A boiler room 18 × 14 ft. is also to be erected.

CARROLLTON, ILL.—Bids are asked until Jan. 14 for electric lighting, according to reports. Ornan Pierson, Mayor.

CHICAGO, ILL.—We are informed that the commissioners of Lincoln Park, Academy of Science Bldg., Center St., are considering plans for an electric light plant. H. C. Alexander, Supt. Comrs.

CLARENCE, ILL.—B. T. Rutledge has applied to the council for a 20-year franchise for an electric light plant.

HOMER, ILL.—It is reported that T. H. French is arranging to construct an electric light plant.

ROCKFORD, ILL.—The construction of an electric light plant in connection with the county hospital is being considered. E. W. Brown, Mayor.

SHELDON, ILL.—G. W. Songer, proprietor of the Cissna Park electric light plant, is reported as considering the matter of establishing a plant at Sheldon.

GRINNELL, IA.—J. F. Wilson, Cy. Clk., writes us that the question of an electric light franchise must be voted upon by the people, which will probably be submitted soon. No plans have yet been adopted. Address F. E. Hull, Grinnell.

ST. ANSGAR, IA.—M. Moe, L. C. Lubiens, A. N. Lund and O. H. Koch have been appointed a committee to consider the advisability of constructing an electric light plant to cost $2,700.

ST. LOUIS, MO.—We are informed that the Whitman Agricultural Co., 6000 South Broadway, St. Louis, will erect a plant to consist of 10 brick buildings with steel truss roofs, estimated to cost $100,000. The contracts for the engines, boilers, etc., have been placed, but that for the electric light plant has not yet been awarded. Arch., Louis Zeller, St. Louis.

GALENA, KAN.—Press reports state as follows: Owen Ford, at the head of Ohio capital, has purchased the Galena Light & Power Co.'s plant, and will immediately increase the capacity sufficient to furnish power for the operation of machinery throughout the mines. A power house, covering almost the entire block, will be at once erected, and an electric line from Empire City to Spring Grove, thence to Standley, through the mines southwest of the city, and another line east on Seventh St., through East Galena, is also to be built. It is expected that not less than $100,000 will be spent on the enterprise.

TOPEKA, KAN.—It is stated that the city engineer has been directed to make surveys for about 10 miles of additional wire for the electric light plant. Several improvements will be made, among which will be a 75-HP. engine, three 100-light dynamos, etc. As soon as the surveys are completed bids will be asked for furnishing the machinery.

BEATRICE, NEB.—The council is considering holding an election to vote on the question of constructing an electric light plant to cost $10,000.

SPOKANE, WASH.—The light commissioners have recommended to the council the purchase or the construction of an electric light plant in connection with the water-works.

SAN FRANCISCO, CAL.—The Bend Power Co. has been organized at Coulterville, Mariposa county, Cal., to build an electric power plant on the Merced River a mile above Horseshoe Bend. Plans and estimates have been prepared for a dam and a ditch and flume 1½ miles long. The capital stock is $500,000, but it is stated that the plant will cost only $150,000. P. P. Most, Mayor, Springfield, O.; H. H. Clark, of Coulterville, and Dr. F. M. Hopkins, of San Francisco, are interested.

BRIDGES.

BELFAST, ME.—It is stated that the secretary of war has approved of the location for the proposed bridge over the harbor at Main St. Work will probably not be begun until spring.

MONTAGUE, ME.—J. H. McNamara, Engr., Oldtown, Me., writes us that the Berlin Iron Bridge Co., of East Berlin, Conn., has been awarded the contract for constructing the Howland bridge, at a cost of about $45,000. About 1,500 cu. yds. of masonry will be required. Bearce & Clifford are the contractors for the stonework. Des. Engr., C. V. Pendleton, Yantic, Conn.

BOSTON, MASS.—We are informed that nothing definite has yet been decided concerning the construction of the bridge over the Charles River, to cost $300,000, as noted in our issue of last week. The structure may be built next year or the year after. Wm. Jackson, Cy. Engr.

NEWTON, MASS.—The Boston & Albany Ry. Co. has prepared plans for 17 steel bridges in this city for abolishing grade crossings. The tracks will be depressed, the excavation in some places being to a depth of 15 ft. The total cost of the proposed change of tracks is estimated roughly at $2,000,000. The city will bear 10% of this cost, the state 25% and the railway company 65%. The entire construction and expenditure will be in charge of a commission of three men, not residents of the city, to be appointed by the Superior Court. H. D. Woods, Cy. Engr.

BUFFALO, N. Y.—Bids are asked until Dec. 27 for constructing the abutments, piers and approaches for the proposed lift bridge over the Buffalo River at Michigan St. As stated in our issue of last week, the Wisconsin Bridge Co., of Milwaukee, has the contract for the superstructure, to cost $38,700. The council recently granted an appropriation of $75,000 for the entire bridge, but it is thought that a larger amount will be needed, as the substructure will be very massive. R. G. Parsons, Secy. Dept. Pub. Wks.; Ch. Engr., S. J. Fields, 13 City and County Hall, Buffalo.

ROCHESTER, N. Y.—The supervisors are considering the question of constructing a bridge over the Genesee River between Rush and Wheatland.

PHILADELPHIA, PA.—We are informed that an appropriation of $250,000 has been recommended for the rebuilding of Gray's Ferry bridge, the railway companies using the bridge are expected to pay the balance. A portion of the structure broke down Dec. 4, as noted in our issue of last week. J. Gray Bolton, Chn. Com.

ATLANTA, GA.—The bridge committee of the council will probably soon advertise for bids for constructing a bridge over the railway tracks at Jones Ave., the contract for which may be let in January.

NEW ORLEANS, LA.—Our correspondent informs us that the following bids were received by the finance committee Dec. 14 for constructing a bridge over the New Basin Canal at Claibourne St.; L. W. Brown, Cy. Engr.; Chas. R. Kennedy, Comptroller:

	Plate Truss.	girder.
Mo. Valley Br. & Ir. Wks., Leavenworth.	$10,748	$10,795
Toledo Bridge Co., Toledo, O.	10,990	13,474
Penn Bridge Co., Beaver Falls, Pa.	13,100	13,300
Gillet-Herzog Mfg. Co., Minneapolis.	10,000	11,250
Geo. Surgi, New Orleans, La.	10,817	No bid.

Two or three more bids were submitted, but were withdrawn just before bids were opened.

YOUNGSTOWN, O.—We are informed that the council has declared its intention of constructing an iron bridge of one span, 60 ft. wide, over the Youngstown River, the foundation of which will be of stone. The time has not been set for letting the contracts, but they will probably be awarded next spring. Address J. M. Davis.

RICHMOND, IND.—Our correspondent informs us that action will probably be taken soon toward awarding the contract for the proposed bridge, as the right of way has been secured by the county commissioners.

DETROIT, MICH.—Notice has been given, according to despatches from Ottawa, Ont., that the Canada & Michigan Bridge & Tunnel Co. will apply to parliament at its next session for authority to build a high level bridge over the Detroit River, between Windsor, Ont., and Detroit. The promoters of the company comprise D. O. Mills, of New York, N. Y.; Andrew Onderdonk, 1 Broadway, N. Y.; James Ross, of Courtright, Ont., and other wealthy Canadians. The company, which organized several years ago, is not connected with any particular railway, although most of the promoters of it are interested in railway enterprises.

ESCANABA, MICH.—D. A. Brotherton, Engr., 810 Charlotte, St., Escanaba, writes us that the following bids were received Dec. 10 for the construction of two steel spans, each 100 ft., and 180 ft. of wooden approaches on cedar spiles over the Whitefish River, near Rapid River:

Milwaukee Bridge & Iron Works, Milwaukee, Wis.	$4,539
Massillon Bridge Co., Massillon, O.	4,591
Toledo Bridge Co., Toledo, O.	4,615
New Columbus Bridge Co., Columbus, O.	4,627
Wisconsin Bridge & Iron Co., Milwaukee.	4,659
Wrought Iron Bridge Co., Canton, O.	4,664
Attica Bridge Co., Attica, Ind.	4,691
Lafayette Bridge Co., Lafayette, Ind.	4,695
John J. Granville	4,700
King Bridge Co., Cleveland, O.	4,713
R. D. Wheaton Bridge Co., Chicago, Ill.	4,750
*Gillett-Herzog Mfg. Co., Minneapolis, Minn.	4,490

* Awarded contract.

CHICAGO, ILL.—Bids are asked until Dec. 28 for the erection of the pile, timber, concrete and masonry substructure for the new rolling bacule bridge over the north branch of the Chicago River at North Halsted St. This bridge will probably cost about $100,000. W. D. Kent, Comr. Pub. Wks.

MARINETTE, WIS.—E. L. Shaw, Cy. Engr., has recommended the advertising for bids for the construction either of a steel bridge of 50 ft. spans and 20 ft. roadway, on pile foundations, estimated to cost $20,000, or a wooden bridge to cost $14,000. Menominee, Mich., is to pay one-third of the cost.

DAVENPORT, IA.—C. F. Loweth, Engr., 94 East North St., St. Paul, is making plans for the substructure of a bridge between Davenport and Rock Island, Ill., over the Mississippi River, for the Davenport & Rock Island Bridge Ry. & Terminal Co. We are informed that it is expected to begin work at once on the foundations, which will include over 5,000 cu. yds. of masonry. The superstructure will be arranged for as soon as the masonry is under way.

BURLINGTON, KAN.—Bids are asked until Jan. 13 for building a steel bridge 80 ft. long, with a 12-ft. roadway. T. N. Bell, County Clk., Burlington.

LEAVENWORTH, KAN.—Bids are asked until Jan. 6, according to reports, for building a bridge in Kickapoo township and one in High Prairie township. J. W. Niehaus, County Clk., Leavenworth.

ST. LOUIS, MO.—The house of delegates has passed the bill for constructing a bridge over Clark Ave. at Moore St., for which the Union Depot Co. is to pay $150,000, according to local papers.

FARGO, N. DAK.—It is stated that representatives of the Northern Pacific Ry. Co. are here, having a survey made of the proposed viaduct on Eighth St.

The street crosses the yards and continuous switching materially delays the traffic, and it has come to a question of removing the yards further out or making the proposed improvement.

YANKTON, S. DAK.—Press reports state as follows: Alfred Noble, a member of the Nicaragua Canal Commission, was here recently taking observations for a railway bridge across the Missouri River. Some time ago a survey was made by N. D. Miller, Ch. Engr. Great Northern Ry., which differed with the surveys previously made by the Missouri Valley Bridge & Iron Works, Leavenworth, Kan. The difference was finally left to Mr. Noble for arbitration.

HOUSTON, TEX.—The county commissioners' court received the following bids Dec. 9 for constructing a bridge 85 ft. long with an 18-ft. roadway, over Buffalo Bayou, at Shepherd's Dam, about three miles north of the city; John G. Tod, County Judge, Houston; W. A. Polk, County Surv.:

King Bridge Co., Cleveland, O.	$2,999
Youngstown Bridge Co., Youngstown, O.	2,747
Wrought Iron Bridge Co., Canton, O.	2,900
Farnsworth & Blodgett, Kansas City	3,418
Groton Bridge & Mfg. Co., Groton, N. Y.	3,219
New Columbus Bridge Co., Columbus, O.	2,893
*Penn Bridge Co., Beaver Falls, Pa.	2,595
Geo. E. King Bridge Co., Des Moines, Ia.	3,740
Mo. Valley Bridge Co., Leavenworth, Kan.	2,999
F. T. Woodward, Dallas, Tex.	2,972

* Awarded contract.

CHEYENNE, WYO.—Bids are asked until Jan. 8 for constructing a bridge over the North Platte River near Fairbank either on wood piles or on plans prepared by the bidders. We are informed that the Union Pacific, Denver & Gulf Ry. Co. proposes to build a spur from near Badger, on the Cheyenne Northern R. R., which is a part of the U. P., D. & G. Ry., if the county will build a bridge over the river. The Hartville iron and other minerals are wanted in Colorado, therefore the bridge and spur. W. D. Pease, County Surv., Cheyenne; Louis G. Jenks, County Clk.

SEATTLE, WASH.—It is stated that the county commissioners on Dec. 6 received the following bids for the construction of the proposed bridge on Alki Ave., West Seattle: Conway & Bogart, for one-quarter mile, $1.10 per lin. ft. for main bridge, and $1.45 for turnouts; for one half-mile, $1 for bridge and $1.05 for turnouts; W. M. Johnson, 69 cts. per lin. ft.; Joseph Gandeon, 66 cts. (awarded contract); K. Olson, $1.10; Daniel Graham, $1.10 quarter mile, $1.05 half mile; Isaac Newell, per lin. rod, $15.25; Geo. B. Kittinger, for one-quarter mile $1.15 for main bridge and $1 for turnouts, half-mile $1.65 for bridge and $1.55 for turnouts. The board has not decided whether to build a quarter or half-mile bridge.

SAN FRANCISCO, CAL.—It is reported that the next big piece of work to be done on the San Joaquin Valley Ry. will be the building of a bridge across the Merced River. The structure will be over half a mile in length, and will be the longest on the line. Contracts for 600,000 ft. of lumber for the trestle approaches and the piers were let Dec. 10, but actual work will not be begun for 30 or 60 days. The contract for 300,000 ft. of pine has been awarded to P. A. Buell, of Stockton, and one of the same quantity of redwood to E. A. Hooper & Co.

KEMPTVILLE, ONT.—It is reported that G. F. Martin, of Smith's Falls, Ont., is making surveys for a swing bridge.

BUILDINGS.

BATH, ME.—Plans are being prepared for a $40,000 city hall, according to reports.

BOSTON, MASS.—Winslow & Wetherell, Hamilton Place, Boston, have prepared plans for a six-story brick and stone addition to the Parker House. Work will be begun at once. The structure is to be completed in about a year.

CAMBRIDGE, MASS.—Waite & Cutter, 85 State St., Boston, have prepared plans for a $260,000 county building.

NARRAGANSETT PIER, R. I.—F. M. Churchill, 85 Devonshire St., Boston, has completed plans for a $300,000 brick hotel for the Narragansett Pier Hotel Co.

PROVIDENCE, R. I.—Bids are asked until Dec. 28 for plumbing, heating and ventilating the west side high school building to be erected at Summer and Pond Sts. Archs., Martin & Hall, 502 Industrial Trust Bldg., Providence; David Burton, Chn. Com., City Hall.

BUFFALO, N. Y.—The following bids have been received by the board of public works for heating and ventilating the new high school building: Buffalo Forge Co. (awarded contract), $17,493; L. H. Prentice & Co., $20,354; John W. Danforth, $20,997; Irlbacker & Davis, $22,650; B. F. Sturtevant Company, $22,900. All are from Buffalo.——Boughton & Johnson, Swan and Erie Sts., have prepared plans for a five-story apartment house for A. C. Spann and R. A. Kellogg at 401 Delaware Ave. Estimated cost, $55,000.

NEW YORK, N. Y.—Bids are asked by the board of education until Dec. 24 and 26 for heating portions of three school buildings and making improvements to others.——David H. King, Jr., 4 West 43d St., will build an eight-story brick hotel, 45 × 125 ft., at 514 Fifth Ave., to cost $150,000. Archs., Howard & Cauldwell, 32 Pine St., New York.——John Kehoe, 335 East 15th St., has filed plans for a seven-story brick warehouse at West and Vestry Sts., to cost $125,000.——Alfred Zucker, 33 Union Square, is the architect for a $500,000 brick and stone business building for Gutwillig & Bros.

ROCHESTER, N. Y.—Chas. F. Crandall has been engaged by the council to prepare plans for remodeling a portion of the city hall.

WEST POINT, N. Y.—Bids are asked until Jan. 13 for constructing a memorial hall, as stated in our advertising columns. Capt. J. B. Bellinger, A. Q. M.

YONKERS, N. Y.—The council has voted to build a $100,000 city hall, although the mayor may veto the ordinance. John G. Peene is mayor.

NEWARK, N. J.—Press reports state that a large tract of land at Broad and Central Aves. has been purchased by the Newark Gas Co. from the estate of Aaron Ward for $65,000, and the company will erect upon the site a large office building, in which will be consolidated the two offices now in use by the company, one on Bank St., and the other on Front St.——The council is to petition the legislature for an appropriation of $300,000 for the purchase of a site, and for the construction of a public library. The last legislature appropriated $175,000 for this purpose, although $250,000 was asked for.

PHILADELPHIA, PA.—Bids are asked until Dec. 28 for the purchase and removal of buildings, etc., on lands secured as a site for the new mint building. S. Wike, Acting Secy. Mint; Herman Kretz, Supt. Mint Bldg., Philadelphia.

BRADDOCK, PA.—The Second Ave. Traction Co. has purchased a plot of ground in Braddock, 80 × 120 ft., at Braddock Ave. and 13th St., from the Robinson heirs for $6,500. On it the company will erect five brick car barns and offices. All the cars on the Braddock and Wilmerding lines will be stored there.

BALTIMORE, MD.—Bids are asked until Jan. 2 for furnishing and erecting the metalwork for the Smith Point Light Station, Va. Maj. E. H. Ruffner, U. S. Engrs., Baltimore.

ST. AUGUSTINE, FLA.—It is reported that Edwin Washington, Engr. South Beach Ry. Co., is making arrangements to build an aquarium just at the exit of the Matanzas River bridge on the east side. The house will be erected over the river on piling.

NASHVILLE, TENN.—It is stated that contracts will be let at once for the erection of a block of four-story buildings on Union St., estimated to cost $35,000. Other buildings are also to be erected in this street. Mrs. Thomas Menees and L. Lusky are interested.

CANTON, O.—Bids are asked until Dec. 23 for the heating and ventilating apparatus for the new South Market St. school building. A. O. Sientz, Clk. Bd. Education, Central High School Bldg.

CLEVELAND, O.—It is reported that work will be commenced in the early spring on a new hotel on St. Clair St. David and Davis Hawley, of the Hawley House, own a tract of land from St. Clair and Ontario Sts. to Rose Alley, and it is upon this that they intend to erect the new hotel. John Eisenmann, Arch., is drafting the plans for the building, which will be eight stories in height.——The plans for the new eight-story opera house to be erected opposite the New England Building have been sent to New York. The estimated cost is $700,000. T. A. Lamb, of New York, N. Y., and Lawrence Lamb, of Memphis, Tenn., are interested.——The chamber of commerce decided Dec. 9 to erect a new building on the public square, which is to cost, together with the site, $500,000.

MASSILLON, O.—The trustees of the state hospital have asked for an appropriation of $200,000, with which it is proposed to inclose the administration building, erect two hospital buildings capable of accommodating 125 persons each, four cottages, and put in operation heating and lighting plants and fit up the institution ready to accommodate 500 patients by early in 1897.

DELPHI, IND.—Alfred Guindle, of Fort Wayne, has prepared plans for a new county court house in Rensselaer.

CHICAGO, ILL.—Bids are asked until Dec. 27 for moldings, lumber, etc., required for half a year, and until Jan. 10 for the erection of a 28-room, stone and iron school building on Gothe St., near Wells St. Arch., August Fiedler, 1117 Schiller Building, Chicago; address the business manager of the board of education, 109 Randolph St.

CHAMPAIGN, ILL.—It is reported that the university is asking for bids for the construction of a new observatory. Address Prof. I. O. Baker.

PONTIAC, ILL.—Press reports state that a new $75,000 reformatory at Pontiac will be built according to the plans drawn by M. E. Bell, Dexter Bldg., Chicago. The building will be 233 ft. long and 85 ft. wide, three stories, high, of pressed brick with stone trimmings. The wainscoting will be of marble, the floors laid in marble mosaic, and the building heated throughout by steam and lighted by gas and electricity. C. E. Felton, of Chicago, and Valentine Jobst, of Peoria, are on the committee.

PEORIA, ILL.—Contracts will probably soon be awarded for constructing the insane asylum buildings. Chn. Comn., John Finley, of Peoria.

ROCK ISLAND, ILL.—The board of trustees of the new western hospital will, it is reported, soon advertise for bids for erecting the buildings. Address T. J. Medill, Jr., Rock Island, or Wm. S. Gales, of Galesburg, Ill.

LESUEUR CENTER, MINN.—Bids are asked until Dec. 30 for the erection of a new brick county court house. Plans and specifications may be seen at the following places: Joseph Rachac, County Audr., Room 1611, Unity Bldg., Chicago, Ill.; C. W. Babcock & Co., Kasota, Minn.; the Northern Hydraulic Pressed Brick Co., Minneapolis, Minn.; state auditor, St. Paul, Minn.; George J. Dressel, Waterville, Minn. Wm. Van Antwerp, Chn. County Comrs.

HILLSBORO, MO.—An election is to be held Dec. 22 to vote on the question of issuing $60,000 in bonds for a new county court house, according to reports.

PLATTSBURG, MO.—C. P. Schmidt, Kansas City, Mo., has prepared plans for a new court house. Address J. P. Lewis, Plattsburg.

KANSAS CITY, MO.—Building permits have been granted for a new two-story public library building at 500 to 510 East Ninth St., 139 × 134 ft., to cost $113,000. Address W. A. Kelly.

ST. LOUIS, MO.—S. M. Carter & Co., have been awarded the contract for constructing an 18-story office building at Sixth and Olive Sts., to cost $700,000. Archs., L. B. Wheeler and Craig McClure; James M. Carpenter, Pres. St. Louis Real Estate Exchange, St. Louis, is interested.

DENVER, COLO.—Fisher & Humphreys are preparing plans for a $150,000 auditorium for the public park. John G. Gallup, Park Comr.

FRESNO, CAL.—Bids are asked until Jan. 27 for reconstructing the county court house, which was partially destroyed by fire July 29, 1895. Check, $5,000. Arch., John M. Curtis, 126 Kearney St., San Francisco; T. G. Hart, Clk. Supervisors, Fresno.

WATER-WORKS.

LIMERICK, ME.—C. F. Philpot, Town Clk., writes us that the town has voted to exempt from taxation for a term of years any system of water-works that may be constructed, but that nothing definite has been decided in regard to a system.

WATERBURY, VT.—At a special village meeting Dec. 9 it was voted to construct works estimated to cost $34,000. The supply will be from springs about six miles distant. Bids for the construction were recently received, as advertised in Engineering News. C. D. Robinson, Secy. Com.

BROCKTON, MASS.—Bids are asked until Jan. 10 for furnishing a 5,000,000-gallon pumping engine. E. A. Reynolds, Chn. Comrs.

CLINTON, MASS.—The water board has requested the town to petition the legislature for authority to issue $50,000 in water bonds for extensions.

HATFIELD, MASS.—Bids are asked until Dec. 28 for a supply of cast iron pipe. Owing to a typewriter's mistake we were directed to change this date last week from Dec. 27, as originally ordered, to Dec. 20, instead of to Dec. 28, as intended. E. C. & E. E. Davis, Engrs., Northampton, Mass.

HOLYOKE, MASS.—W. E. McClintock, of Boston, has been engaged by the water commissioners to pass upon the merits of the proposed new water supply, and was in the city last week for this purpose.

LOWELL, MASS.—Bids are asked until Jan. 1 for furnishing 525 tons of 12 to 6-in. cast iron pipe, as stated in our advertising columns. Geo. E. Putnam, Pres. Bd.

PROVIDENCE, R. I.—Bids are asked until Dec. 20 for furnishing 1,253 gross tons of 16 to 4-in. cast iron pipe, of which 1,077 tons will be 6-in. Robt. E. Smith, Comr. Pub. Wks.

HARTFORD, CONN.—The water commissioners have authorized the president to prepare specifications for a new 36-in. main from the reservoir at West Hartford to Main St., 5½ miles, estimated to cost $250,000.

NORWALK, CONN.—At a special city meeting Dec. 9, the citizens voted against the proposed appropriation of $16,500 for a sand filter in connection with the new reservoir.

BOONVILLE, N. Y.—B. A. Capron, Village Clk., writes us that G. C. Ward is preparing plans and estimates, and that the question of construction will be submitted to a vote of the people as soon as the estimates are completed, which will probably be in about two weeks.

CLIFTON SPRINGS, N. Y.—At an election Dec. 10, this village voted in favor of water-works. It is stated that the supply will be secured four miles distant, from an elevation of 245 ft. above the village.

DE RUYTER, N. Y.—H. J. Fellows, Village Clk., writes us that a water board has been appointed, and a vote will soon be taken on a question of issuing bonds for works; population, 800. Address H. D. Preston.

NEW YORK, N. Y.—The New York & Westchester Water Co. has called a meeting of the stockholders for Dec. 23 to vote on an increase of the capital stock from $500,000 to $10,000,000. It is also stated that a special meeting will be held Jan. 29 for the purpose of guaranteeing the bonds issued by the Upper New York City Water Co.

ONEIDA, N. Y.—A. E. Loomis, Supt., writes us that the Stanwix Engineering Co. is preparing plans for a new reservoir on the same stream now used for a supply, and that the construction will probably be commenced early in the spring. The money is already at the disposal of the committee. Wm. Baker, Pres.

TARRYTOWN, N. Y.—The contract for constructing reservoir embankments, as advertised in Engineering News, was awarded to Van Vranken & Duell, of Tarrytown, on Dec. 16, at $39,200. The itemized bids will probably be published next week. Engr., D. S. Merritt.

WEEDSPORT, N. Y.—The incorporation of the Weedsport Water Co. was noted last week. We are informed that F. C. Reynolds, of Moravia, N. Y., will purchase the materials and award all contracts. The system will be constructed in the spring; population, 2,000.

ELIZABETH, N. J.—It is reported that a company is being organized to supply this place with water from artesian wells.

MOUNT JOY, PA.—The clerk of the water committee has been directed to correspond with manufacturers in regard to the purchase of a new pump.

OIL CITY, PA.—H. H. Culbertson writes us that it is proposed to move the pumping station and secure a supply from wells located in a gravel bed near the river, but that no definite plans have yet been made.

FRANKLIN, VA.—W. T. Pace, Recdr., writes us that J. P. Gay and J. R. Knight have been appointed a committee on construction of new works; population, 1,500. This item was printed last week under Franklin, Pa.

NORFOLK, VA.—Bids are asked until Dec. 28 for sinking a test well 3,000 ft. deep. R. Y. Zachary, Supt.

WASHINGTON, N. C.—Bids are wanted for one or two 6-in. wells. J. Havens, Mayor.

UNION, S. C.—T. C. Duncan is chairman of the committee noted last week as appointed to secure information in regard to works. It is stated that $40,000 in bonds will probably be issued for water-works and an electric light plant, and that the contracts will be awarded at an early date.

ATHENS, ALA.—Z. S. Parker, Pres., writes us that a water-works and electric light plant is wanted for the college. The town also contemplates constructing works.

GREENWOOD, MISS.—Bids are asked until Jan. 6 for constructing works, according to reports.

BAY ST. LOUIS, MISS.—The awarding of contracts for works has been postponed until the question of a reduction of insurance rates is decided.

BAINBRIDGE, O.—The clerk writes us that works will not be constructed at present.

CARTHAGE, O.—The Convent of the Good Shepherd is preparing to secure an independent water supply. Henry Kister, of Carthage, is wailing up the springs. The plans include a 40 × 60 × 10 ft. reservoir.

CINCINNATI, O.—Bids are asked until Dec. 30 for masonry, etc., for the foundations for an additional water tank at Mount Auburn; also for 600 bbls. of Portland cement. A. P. Butterfield, Clk. Bd. of Administration. Bids will probably be asked in a few days for constructing the tank.

DEFIANCE, O.—The council has passed a resolution in favor of municipal works, and it is probable that the question of issuing $75,000 in water bonds will be voted upon in April.

FRANKFORT, O.—T. O. Miller, Clk., writes us that the construction of works has been postponed until after the spring election.

LONDON, O.—The question of municipal ownership is being agitated.

MANSFIELD, O.—The trustees are considering the advisability of drilling more artesian wells. Wm. Harmon, of Tiffin, and Starrett & Balliett, of Mansfield, have already submitted propositions.

WELLINGTON, O.—R. N. Goodwin, Clk., writes us that J. B. Strawn, of Salem, and E. Hackett, of Wellington, have made some surveys and estimates with a view to the construction of works, but that the council has not yet taken any action.

BOONVILLE, IND.—Chas. H. Johnson, Town Clk., writes us that an election will be held Dec. 26 at which $25,000 in bonds will probably be voted for the construction of works. A. H. Kennedy, Engr.

CRAWFORDSVILLE, IND.—The entire plant of the Crawfordsville Water & Light Co. was purchased at auction Dec. 14 by agents of the Knickerbocker Trust Co., of New York, for $50,000, the amount of a first mortgage held by the trust company. The water company's indebtedness is said to aggregate $350,000.

MIDDLETOWN, IND.—The bids recently received for works are noted in another column under Contract Prices. Toney C. Hefel, Engr., West Muncie, Ind.

REDKEY, IND.—Toney C. Hefel, of West Muncie, is preparing plans and specifications for works in this city, and the plant will probably be constructed as soon as bonds are sold.

VERNON, IND.—F. D. Baughn, Jr., Town Clk., writes us that the new works are about completed.

VERSAILLES, IND.—We are informed that the water-works proposition has been defeated.

DETROIT, MICH.—The water commissioners have instructed Secretary Case to advertise for bids for 2,000 tons of pipe. Harry P. Barr, of the C. W. Hunt Co., of New York, has prepared plans for a $20,000 coal chute and carrier for the water-works station.

DECATUR, ILL.—The council is reported to have voted in favor of appropriating $25,000 for improving the works.

DES PLAINES, ILL.—Bids are asked until Jan. 6 for furnishing and laying water supply pipes in 16 streets. J. I. Foster, Engr.; E. C. Schaefer, Village Clk.

LA MOILLE, ILL.—Cyrus Hills, Clk., writes us that nothing has been done recently about water-works, but that if dry weather continues, definite steps will have to be taken soon.

LOCKPORT, ILL.—It is reported that bids are asked until Jan. 6 for furnishing and laying a system of water pipe mains. The itemized bids received in November for laying mains, etc., were published in our issue of Nov. 21. F. H. Reed, Clk.

MAPLE PARK, ILL.—John L. Snow, Cy. Clk., writes us that the contract for constructing works has been awarded to the Challenge Wind Mill & Feed Mill Co., of Batavia, Ill., at $3,200.

FORT MADISON, IA.—The Fort Madison Water Co. has purchased pipe and is making extensions under the direction of Col. W. J. McCrew, Supt.; J. Ross Robertson, Cy. Engr

SANBORN, IA.—It is reported that $5,000 has been voted for works, which will probably include a standpipe.

SCRANTON, IA.—It is reported that the citizens have voted in favor of works, which will include a tower and tank.

ST. ANSGAR, IA.—At a recent village meeting the question of water-works and electric lights was favorably considered, though no steps were taken to secure water-works. O. O. Danbowe was chairman, and S. J. Peshak was secretary of the meeting.

DULUTH, MINN.—Bids are asked until Dec. 30 for furnishing about 1,000 ft. of 60-in. riveted steel pipe. We are informed that $1,800,000 in bonds have been voted; $750,000 advertised for sale, $130,000 available in general fund. The bids for laying the steel intake pipe will be asked at once, to be followed by advertisements for excavation, pipe, etc. The plans contemplate one 10,000,000-gallon vertical triple expansion pump, one 3,000,000-gallon and two 1,000,000-gallon pumps, a stand-pipe and two reservoirs. W. B. Patton, Cy. Engr.; C. E. Richardson, Cy. Clk.

ISLAND LAKE, MINN.—A press report states that this part of Lyon county is agitating the question of artesian wells, and it is probable that several will be sunk in this vicinity.

TOPEKA, KAN.—The court has directed the sale of the water-works within six months.

KANSAS CITY, MO.—The superintendent has recommended that new pumping machinery be purchased at a cost of about $100,000.

MARCELINE, MO.—Hiram Long, Cy. Clk., writes us that it has been proposed to construct works, the supply to be from the mains of the Santa Fe railway, now being laid, but the terms of the company, which have just been received, forbid all hope of such an arrangement, and unless a less expensive system can be secured it is not probable that anything will be done; population, 3,500.

MIAMI, MO.—The council has contracted with Delaney Bros., of Slater, Mo., for the construction of works to cost $837.

ST. CHARLES, MO.—A. C. Sandfort, Cy. Clk., writes us that the council has adopted a resolution refusing to grant the water company an extension of its franchise, and has appointed a committee to negotiate for the purchase of the plant for $50,000.

FORT WORTH, TEX.—A. W. Scoble, Supt., writes us that extensions to cost about $10,000 are contemplated, but the money is not at hand at present for the work.

HICO, TEX.—Daniel Pingree, Mayor, writes us that the plans for proposed works are not yet completed; population, 1,500.

WEIMAR, TEX.—J. C. Kindred, Mayor, writes us that no plans have yet been prepared or bids asked. This will probably be done next month.

GRAND JUNCTION, COLO.—Bids are asked until Jan. 7 for excavation and back filling of about 11 miles of ditches in this city, and about 24 miles outside of the city; also for about 800,000 brick, 1,200,000 ft. of lumber, and 1,600,000 lbs. of cast iron pipe and specials. Address W. F. McCue, 703 Boston Building, Denver, Colo.

TACOMA, WASH.—A special committee, appointed three months ago, to investigate the Talbot water proposition, has reported in favor of this plan, and that $330,000 be appropriated for the work. Luke McGrath, Chn. An ordinance has been passed appropriating $500 for the preliminary work, which has already been commenced.

MOUNT VERNON, WASH.—The citizens have voted to issue $14,000 in bonds for works. John L. Anable, Cy. Clk.

POMONA, CAL.—Bids are asked until Jan. 15 for constructing works, as described in our advertising columns. W. H. Sanders, Cy. Engr.; J. R. Garthside, Cy. Clk.

SUISUN CITY, CAL.—O. B. Powers, Town Clk., writes us that an election will probably be held about Feb. 1 to vote on the construction of works, estimated to cost $40,000. The supply will be from springs 8½ miles distant and having an elevation of 700 ft. above the town. The plans call for two reservoirs, two standpipes, 20 hydrants, etc. Engr., O. H. Buckman, Napa City, Cal.

OTTAWA, ONT.—The water committee is reported as about to petition for authority to issue $125,000 in bonds for extensions and improvements. It is stated that $63,000 will be required for new pumps.

IRRIGATION.

SARGENT, NEB.—Bids are asked until Jan. 6 for the purchase of $100,000 of 6% irrigation bonds of the Middle Loup Valley Irrigation District. Chas. Nicolai, Secy., Sargent.

HOLYOKE, COLO.—John C. Swan, of Greeley, Colo., has been awarded the contract by the state engineer for sinking an artesian well 1,300 ft. deep, with a 6-in. casing, at about $4,500.

VISALIA, CAL.—Surveys are being made by the Kweah Irrigation & Power Co., for its proposed ditch. Capital stock, $300,000. Elisha C. Wane, Chicago, Ill.; A. G. Wishon, Tulare, Cal., and O. C. Ainsworth, Pasadena, Cal., are interested.

NEW COMPANIES.—Lower Delta Ditch Co., Greeley, Colo.; $2,400; Alex. Mead, Wilson B. Wolfe, Samuel S. Wylie.

SEWERAGE.

CAMBRIDGE, MASS.—The aldermen have ordered the construction of sewers in five streets. L. M. Hastings, Cy. Engr.

HYDE PARK, MASS.—A bill will probably be introduced in the legislature authorizing the construction of a system. Address F. W. Darling, Hyde Park.

WESTBORO, MASS.—It is stated that the sewerage problem connected with the state lunatic asylum here, with its 577 patients, is engaging the attention and careful study of the authorities, who are making investigations of different systems of sewage disposal.

BUFFALO, N. Y.—Bids are asked until Dec. 27 for constructing 20 to 10-in. pipe sewers in two streets. R. G. Parsons, Secy. Dept. Pub. Wks.

CORTLAND, N. Y.—The Cortland Park Land Co. has been incorporated to build houses, a boulevard, sewers and water-works on a tract of land purchased by it outside the city limits; capital stock, $30,000. Pres., Herman Bergholtz; Secy., Horace E. Hand.

FULTON, N. Y.—It is probable an election will be held in the spring to vote again on the question of constructing a system. W. P. Hillick, Cy. Clk.

ROCHESTER, N. Y.—We are informed that the final ordinance has been passed for constructing a $16,000 sewer in Monroe Ave., and contracts will be let as soon as the plans have been prepared.——The Central Ave. outlet tunnel sewer is nearly ready for letting. The shaft is 105 ft. deep and 5 ft. in diameter, and the sewer is 140 ft. long and 6 ft. diameter. J. Y. McClintock, Cy. Engr.; T. S. Culver, Cy. Clk.

SYRACUSE, N. Y.—Bids are asked until Dec. 23 for the construction of 18 to 12-in. pipe sewers in four streets. H. F. Stephens, Cy. Clk.

ATLANTIC, N. J.—It is stated that the Atlantic City Sewerage Co. proposes to improve its filter beds, and that plans for these improvements are now being prepared by John Bogart, Engr. State Bd. Health, Albany, N. Y. Supt., A. M. Jordan, Atlantic City.

PERTH AMBOY, N. J.—Ordinances have passed the council ordering the construction of 36×24-in. brick sewer in two streets. Wm. King, Jr., Cy. Clk.

RED BANK, N. J.—Plans are asked until Dec. 23 for a sewer system, pumping station and sewage disposal plant. Theo. F. White, Comr.; A. C. Harrison, Town Clk.

WILDWOOD, N. J.—The following bids were received Dec. 10 for constructing a sewer:

Lemuel E. Miller, Cape May, N. J.	$8,461
John D'Arcy, Trenton, N. J.	4,866
Thos. J. McGovern, Philadelphia, Pa.	4,567
B. F. Sweeten & Son, Camden, N. J.	4,078
Thos. H. Regan & Co., Philadelphia, Pa.	3,878
Shoemaker & Milloy, Lansdowne, Pa.	3,397

We are informed that all house connections will be laid 1 ft. inside of the curb line, so that the streets will not have to be disturbed to make any connection in the future. The clerk was ordered to send out bills of each individual cost, which is about $17.55 per lot, and 55% of the total cost has to be collected before the borough council can give out the contract, and if the said 55% is not collected in 60 days then the whole proceedings become null and void, according to the laws governing Jersey boroughs.

PHILADELPHIA, PA.—Bids are asked until Dec. 27 for repairing sewers, drains, paved streets, grading, etc., required during 1896. Thos. M. Thompson, Dir. Pub. Wks.

READING, PA.—It is probable that an election will be held in February to vote on the question of issuing $600,000 in bonds for sewers, streets, etc. Henry Eppihimer, Pres. Bd. Pub. Wks.

SWARTHMORE, PA.—It is stated an expert engineer from Philadelphia, in company with John A. Cass, Charles Parker and William J. Hall, of the sewer committee; Richard Ogden, of the highway committee; Surveyor Janvier and E. B. Kay, Engr., went Dec. 11 to the subsiding tanks of the Swarthmore sewer and the territory along Crum Creek for the purpose of investigating the best methods of disposing of the sewage to be carried there. One of two plans will be adopted, depending upon cost and efficiency, either lime tanks or filter beds.

WASHINGTON, D. C.—Bids are asked by the district commissioners until Jan. 25 for constructing a main intercepting sewer, as stated in our advertising columns.

YEADON, PA.—Plans have been prepared for a system, to be built in the spring, according to reports.

BELLEFONTAINE, O.—The construction of a system is being considered.

GLENVILLE, O.—J. F. Brown, Engr., will probably soon submit plans for a system of sewage disposal.

MANSFIELD, O.—The question of sewage disposal is being discussed. F. M. Remy, Cy. Clk.

ZANESVILLE, O.—The council is considering the advisability of constructing a system, to cost $40,000, according to reports.

BELVIDERE, ILL.—The council has adopted plans for a system, to cost $37,700, which will be constructed in the spring.

ATCHISON, KAN.—A. C. Trueblood, Cy. Clk., writes us that no sewer plans have yet been perfected, and it will probably be some time before they are completed. Engr., F. Giddings, Atchison.

KANSAS CITY, KAN.—We are informed that E. O. Parsons has been awarded the contract for building 4,600 ft. of 32-in. sewer, average cut 14 ft., at an estimated cost of $17,000. C. A. Ellis, Cy. Engr.

NEBRASKA CITY, NEB.—It is stated that in the spring the Burlington & Missouri River R. R. Co. will build a storm sewer on its grounds in South Table Creek.

LORIN, CAL.—The Adeline sewer district has been organized, in which a system will be constructed, according to reports.

STRATFORD, ONT.—Alan Macdougall, Toronto, Ont., is the designing engineer for a system of two miles of 24 to 15-in. pipe sewers with an average cut of 12 ft. We are informed that the by-law has been carried to spend $30,000 on the main outfall sewer. The city will purchase the pipes and cement and construct sewers by day labor. Plans for the purification system are now before the provincial board of health. Engr. in Charge, W. F. Van Buskirk; R. R. Lang, Cy. Clk.

GARBAGE DISPOSAL.

PHILADELPHIA, PA.—The American Incinerating Co. is reported about to add another furnace to its garbage incinerating plant at 25th St. and Sedgeley Ave., at a cost of about $16,000.

PHILADELPHIA, PA.—Bids are asked until Dec. 23 for removal and disposal of garbage, etc., during 1896. Thos. M. Thompson, Dir. Pub. Wks.

COLUMBUS, O.—Geo. & Chas. Geigele have been awarded the contract for garbage disposal for 10 years at $15,800 a year. The plant will probably be ready for use by April.

PEORIA, ILL.—The special committee, of which A. D. Thompson, Cy. Engr., and the mayor are members, has submitted a report recommending the adoption of cremation, and the purchase of a Rider, Engle or a Smith crematory.

OAKLAND, CAL.—Local papers state that the Odorless Crematory Co., consisting of Louis Schaffer, Theodore Swift, C. W. Lent and J. W. Swift, is erecting a crematory, and will make an offer to the city to destroy garbage at a reasonable price. The plant is being constructed in order that representatives from other cities may see it in operation.

STREETS AND ROADS.

BOSTON, MASS.—We are informed that the following bids were received by the department of streets Dec. 13 for excavating and grading in Blue Hill Ave.; (1) being for sections 9 and 10 and parts of sections 8 and 11, and (2) for part of section 11 and sections 12 and 13:

	1.	2.
J. D. Gennaro, Boston, Mass.	*$7,925	$10,920
H. P. Nawn, Boston, Mass.	8,190	*10,570
J. Dolan, Boston, Mass.	8,540	.....
Davern & Cronin, Boston, Mass.	9,310	.....
J. McGovern, Boston, Mass.	10,540	.....
T. O'Leary, Boston, Mass.	15,130	18,330
T. Minton, Boston, Mass.	.....	12,925
J. Killian, Jr., Boston, Mass.	.....	15,160

* Awarded contract.

WOBURN, MASS.—It is proposed to rebuild Main St. and other streets in the spring.

NEW HAVEN, CONN.—The question of asphalt paving in two streets at an estimated cost of $70,000 is being considered.

BROOKLYN, N. Y.—Bids are asked until Dec. 20 for flagging sidewalks in about 20 streets, and until Dec. 30 for flagging in about 20 others.——Bids are asked until Dec. 23 for asphalt repaving in 15 streets; until Dec. 27 for granite block paving in four streets, and until Dec. 30 for repaving a portion of Washington Ave. with granite block. Sureties, from $2,000 to $20,000. Alfred T. White, Comr. Cy. Wks.

NEW YORK, N. Y.—Bids are asked until Dec. 30 for asphalt paving in two streets, granite paving in one, and for grading and making improvements in a number of other streets. Chas. H. T. Collis, Comr. Pub. Wks.

ROCHESTER, N. Y.—We are informed that contracts will soon be let for asphalt paving in York and Child Sts., estimated to cost $21,500 and $30,000, respectively. John Y. McClintock, Cy. Engr.

SCHENECTADY, N. Y.—We are informed that the council has received a petition from the residents of Albany St. requesting to have that street paved with asphalt and that the work be done in the spring.

SYRACUSE, N. Y.—Bids are asked until Dec. 23 for asphalt, brick or sand-stone block paving in South Clinton St.; check, $5,000. H. F. Stephens, Cy. Clk.

CAMDEN, N. J.—Bids are asked until Jan. 3 for paving in two streets. Chas. P. Sayrs, Chn. Com.; L. E. Farnham, Cy. Engr.

NEWARK, N. J.—It is proposed to pave portions of 22 streets and construct sewers in several others. Engr., Ernest Adam.

EASTON, PA.—The council is considering an ordinance to be submitted to the citizens to be voted upon authorizing the issue of $100,000 in bonds for street improvements, etc.

BALTIMORE, MD.—Bids are asked until Dec. 28 for paving in Oliver St. Janon Fisher, Cy. Comr.

JACKSONVILLE, FLA.—The board of public works is waiting for authority from the council for letting contracts for 55,127 sq. yds. of brick paving, estimated to cost about $65,000. A. F. Harley, Cy. Engr.

TAMPA, FLA.—It is stated that an election is to be held Dec. 27 to vote on the question of issuing $300,000 of street improvement bonds.

NEW ORLEANS, LA.—The council proposes to pave and construct sidewalks in a number of streets. L. W. Brown, Cy. Engr.

LEXINGTON, KY.—W. J. Loughridge, of Lexington, has been awarded the contract for brick paving in a number of streets.

CINCINNATI, O.—Bids are asked until Dec. 31 for brick paving in three streets and granite paving in one street. A. P. Butterfield, Clk. Bd. Administration.

LANSING, MICH.—The council is considering the question of paving Washington Ave. with brick at an estimated cost of about $100,000, the work to be done next year.

KANSAS CITY, MO.—Bids are asked by the city clerk until Dec. 24 for macadamizing 15th St. at an estimated cost of about $40,000, or about 63 cts. per sq. yd. Bids for this work were received Dec. 11, but as the bids ranged from 70 cts. to 93½ cts. per sq. yd., the bids were all rejected.

HOUSTON, TEX.—The council is considering an ordinance authorizing the issue of $250,000 in bonds for paving. G. M. La Noue, Cy. Engr.

DENVER, COLO.—The board of public works has voted to pave two streets with brick, at an estimated cost of about $45,000. E. Mounsh, Pres. Pub. Wks.; T. J. Milner, Ch. Engr. Bd. Pub. Wks.

SANTA BARBARA, CAL.—It has been decided to extend the Booth's Point Boulevard a distance of two miles to Montecito at an estimated cost of about $20,000.

MANUFACTURING PLANTS.

BROCKTON, MASS.—It is reported that the Brockton Power Co., which recently acquired a tract of land at Montello, will erect thereon three large factory buildings, each 350 ft. in length. The Bouve-Crawford Co., shoe manufacturers, has leased, for five years, one of these buildings.

ALLENTOWN, PA.—W. K. Ruhe informs us that the proposed plan to erect a woolen manufactory to be 400 × 1,000 ft., has not yet been finally agreed upon.—Philip Schneider, 1923 South Hall St., writes us that the plans are completed and contractors are now making their estimates for erecting a factory, as noted in our issue of Nov. 14.

PHOENIXVILLE, PA.—Bids are asked by Byron, Parsons & Co., until Jan. 10 for the erection of buildings for their manufacturing plant. There will be a three-story brick building 46 × 120 ft., and a boiler-house 20 × 46 ft. The buildings will be heated by steam and lighted by electricity. An 80-HP. return tubular boiler; 60-HP. plain slide valve engine; 100 light dynamo and freight elevator will be purchased. The only contract thus far awarded is that for the masonry of basement. Arch., H. G. Ellis, Spring City, Pa.

PITTSBURG, PA.—Press reports say the Pittsburg Car Wheel Co. will build a large plant, at a cost of $150,000, at Home St. and Allegheny Valley Ry., for the manufacture of car-wheels. The capacity of the works will be 60,000 wheels a year. This company is a branch of the New York Car Wheel Co., of Buffalo. P. H. Griffin is president of both companies.

ASHEVILLE, N. C.—Col. Frank Coxe, of this city, has bought for $25,000 the shoals property at Big Island, on Broad River, for a cotton mill site, and will soon build and equip one of the largest cotton mills in the state, to cost not less than $500,000. No contracts have yet been given out, nor have plans and specifications been drawn.

PROSPERITY, S. C.—A. H. Kohn, Secy., writes us that the Prosperity Cotton Mill Co. will erect a building with boiler room attached, 92 × 230 ft., to cost $10,000, and that bids will be received in January. Bids will also be received next month for equipment, consisting of two 150-HP. boilers, one 250-HP. engine and an 80-arc electric light plant, pumping engine, pumps, etc., estimated to cost $55,000.

OWENSBORO, KY.—Press reports state that a cornstalk cellulose factory is to be built at this place; this will be the first factory of its kind to be erected, and will manufacture cornstalk cellulose, a new material for filling the cofferdams of war vessels, as described some time ago in this paper. It is understood that the United States Government has ordered the cellulose to be used in the gunboats Nos. 5 and 6, and will use the product of this factory.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

FIRE HOSE.—Brooklyn, N. Y.—Bids are asked until Dec. 27 for furnishing 15,000 ft. of cotton rubber-lined fire hose. A. T. White, Comr. Cy. Wks.

STREET CLEANING, ETC.—Philadelphia, Pa.—Bids are asked until Dec. 23 for cleaning streets, etc., during 1896. Thos. M. Thompson, Dir. Pub. Wks.

DOCKS.—Buffalo, N. Y.—The aldermen this week voted to call for plans and estimates for building public excursion docks at the foot of Porter Ave.

PARK IMPROVEMENT BONDS.—Hartford, Conn.—Bids are asked until Dec. 23 for the purchase of $150,000 of 3½% park improvement bonds. C. C. Strong, Cy. Treas.

STONE CRUSHER.—Parkersburg, W. Va.—The board of trade is said to be in favor of the county purchasing a stone crusher, at an estimated cost of $1,500. Pres., R. E. Hornor.

FIRE APPARATUS.—New York, N. Y.—Bids are asked by the fire department until Dec. 26 for furnishing 3,000 ft. of 2½-in. fire hose, and until Dec. 30 for three chemical fire engines.

STREET SWEEPER.—Riverside, Cal.—Proposals are asked until Jan. 7 for furnishing a street sweeper, as stated in our advertising columns. James W. Johnson, Cy. Engr.; W. W. Phelps, Cy. Clk.

FIRE APPARATUS.—Philadelphia, Pa.—Bids are asked until Dec. 23 for a supply of fire hose, hand fire extinguishers, one or more steam engines, chemical engines, etc. A. M. Beitler, Dir. Dept. Pub. Safety.

FIRE APPARATUS.—Indianapolis, Ind.—The board of public safety and the mayor have agreed upon $60,000 worth of improvements for the fire department, including the purchase of water tower and engines.

BOILERS.—Brooklyn, N.Y.—Bids are asked until Dec. 31 for furnishing and delivering at caissons No. 2 and 3 Coney Island, two horizontal tubular boilers each 60 ins. diameter and 15 ft. long. A. T. White, Comr. Cy. Wks.

STONE WING WALLS.—San Francisco, Cal.—Bids are asked until Jan. 15 for construction of stone wing walls, at Lombard St. and First Ave. entrances to Presidio of San Francisco. Lieut.-Col. J. G. C. Lee, Dep. Q. M., U. S. A.

RIVER FRONTAGE.—Homestead, Pa.—The Carnegie Steel Co. has purchased property along the Monongahela River, between Duquesne and Homestead, having a frontage of one mile on the river and giving the company 3½ miles of river frontage.

RIVER IMPROVEMENTS.—Pueblo, Colo.—E. W. Hathaway, Un. Engr., has prepared plans for the improvement of the Arkansas River through this city. The plans contemplate the removal of a dam, the construction of new levees, deepening channel, etc.

TUNNEL.—Los Angeles, Cal.—C. S. Compton, Cy. Engr., has been working on plans since last summer for the construction of a tunnel through Fort Hill, which is to give Broadway an opening from Sand St. to the corner of Bellevue Ave. and Buena Vista St.

TUNNEL WORK.—Jersey City, N. J.—The street and water board has authorized the Erie Ry. Co. to close Tonnele Ave., temporarily at the point where the avenue crosses the entrance to the west end of the Erie tunnel. The company wants to rebuild that part of the tunnel.

DRAINAGE DITCH.—Charlotte, Mich.—Bids will be received until Dec. 24, according to reports, for the deepening, widening, straightening and extending of the Perkins' drain, located and established in the township of Chester, Eaton county. H. E. Newcomb, County Drain Comr.

PARK SYSTEM.—Indianapolis, Ind.—The park commissioners have ordered surveys of about 2½ miles of White River and 6 miles of Fall Creek. The surveys are well under way, and will give full topographical details, and will be the basis for purchases and condemnation of property for the new park system. It is expected that the surveys will be continued until they have surrounded the city on the west, north and east.

STEAMBOAT.—Lewiston, Idaho.—J. H. Brown and others have organized the Clearwater Navigation Co., with a capital stock of $25,000, of which $13,500 has been subscribed. As soon as the plans are completed, it is stated that a steamer will be built at this place. It will be 130 ft. in length, 30 ft. beam and have capacity of 250 tons. The company will operate on the Clearwater River to the head of navigation in the Nez Perce reservation.

ORE DOCKS.—Superior, Wis.—A press report states that the Duluth & Winnipeg Ry. Co. has let to M. J. Peppert, of Minneapolis, the contract for an important extension to its ore docks in this city. They are at present 700 ft. long, and in view of the contracts already made for next season's business, an addition of 900 ft. is to be made, and the number of ore pockets increased from 100 to 250. The work will cost $200,000, and will be completed this winter.

HARBOR WORK.—Galveston, Tex.—The directors of the Texas City Improvement Co. at a meeting Dec. 6 are reported to have completed arrangements for letting the contract to complete the channel from Bolivar Channel to Texas City to a depth of 16 ft. J. R. Myers, Vice Pres. and Gen. Man., was authorized to let the contract to one or more responsible contractors, so that the work might be completed by the early spring. Docks will soon be built, and it is expected that 15 ocean steamers can be accommodated at Texas City by next season.

MINING PLANT.—Wentworth, Mo.—The "Journal" states that ground has been broken for the erection of one of the largest and most complete mining plants in southwest Missouri. It will be located just outside the town limits of Wentworth, on land which is under lease to General Hamar, and which has been prospected thoroughly during the past two or three years, with satisfactory results. The extent of the plant is indicated by the area to be covered, the excavation for foundation work being 112 × 70 ft. Contracts for the masonry have been let to Cheatham & Blackman, of Peirce City, and the work has been commenced. The rock contract, which includes about 300 perch, was awarded to J. R. Stilley.

CANAL.—Galveston, Tex.—Press reports state that the Texas Coast Canal Co. has been organized to build a canal from Galveston to the Rio Grande. It is said that there is already a natural canal the greater portion of the distance, made by the inclosure of water by Galveston Island, Matagorda Peninsula, Matagorda, St. Joseph's, Mustang and Padre Islands, and the scheme is to connect these channels by artificial canals, making an inland water route from Galveston to the Rio Grande. It is said that the work will begin on the canal immediately, and that it will be pushed to completion as rapidly as possible. The work will begin by widening and deepening West Union Bayou, which opens into the Brazos River, about a half mile above Quintana. This canal will make a direct inland route from Brazos, Santiago, to Velasco, and on through the Brazos and Galveston Canal to this city. The first work from the other end will be between Corpus Christi and Baffin's Bay. The canal will be 150 ft. wide and 5 ft. deep. The canal company has arranged to put a large colony from Denmark upon lands along the line. The work will be under the supervision of Col. A. Boshke.

DRY-DOCK.—New York, N. Y.—It is reported that the shipbuilding and repairing firms are making preparations for the construction of a large dry-dock at Communipaw. The reason for this action is said to be the fact that the New York Dry-Dock & Repairing Co., composed of Philadelphia capitalists, has acquired control of all the dry-docks in this region, and that the various firms are now shut out from the use of these docks. Many of the shipbuilding and repairing firms are quoted as saying that they are on the point of closing down simply because they are unable to hire dry-docks in which to place vessels. Many of the dry-docks are empty, but the trust, it is alleged, purposely keeps them so in order to throw the work into their own repair shops at Erie Basin. In addition to building the dock, it is reported that the firms propose petitioning the attorney-general to take action against the Dry-Dock Trust. The firms who, it is said, stand ready to sign the petition are the W. A. Fletcher Works, of Hoboken; the Ross Iron Works, of South Brooklyn; the John McNeill Works, of Brooklyn; Donald McNeill, of Brooklyn; the Morse Iron Works, of New York; the Morgan Iron Works, of East Ninth St., New York; the Dumbarton Iron Works, of New York; the Reid & Duff Works, New York; Greenlie, Wyatt & Co., New York, and the Quintard Iron Works, of New York. It is also reported that a movement has been started by Mr. Townsend, of the firm of Townsend & Downey, the Morse Iron Works, Produce Building annex, to organize a company to build a floating dry-dock. As matters now stand, owners of damaged vessels must either consent to the rates charged by the trust or go to Newport News for repairs.

CONTRACT PRICES.

WATER-WORKS.—Middletown, Ind.—Toney C. Hefel, Engr., West Muncie, Ind., has sent us a detailed statement of the bids received Dec. 5 for constructing waterworks. Goodrich & Camp, of Winchester, Ind., bid $16,300 for complete plant; John Williams, of Dayton, O., $14,817 for complete plant, except wells and foundation; W. S. Wagner, of Minneapolis, $14,338, complete, except foundation. The bids for pipe ranged from $21 to $24.70 a ton; specials, 2¼ to 2½ cts. a lb.; 15 valves and 29 hydrants, $582 to $856; laying 4, 6, 8 and 10-in. pipe, 10 to 11½ cts., 12 to 14 cts., 14 to 16½ cts. and 16 to 20 cts. a ft., respectively; driven wells, 6-in., $1.80 to $2.75, and 8-in., $2 to $3.25 a ft. The bids for two boilers, 50-ins. × 14 ft., were as follows:

Fulton Boiler Works, Richmond	$1,800
Chandler & Taylor, Indianapolis, Ind.	1,650

The bids for two 750,000-gallon duplex compound pumps with boilers complete, were as follows:

Smith & Valle Co., Dayton, O.	12 × 16 × 9 × 12	$3,915
Laidlaw-Dunn-Gordon Co.	8 × 12 × 8½ × 12	3,587
Hughes Steam Pump Co.	10 × 14 × 8½ × 12	3,500
J. H. McGowan, Cincinnati	8 × 12 × 8½ × 12	3,798
Henry R. Worthington, New York	8 × 12 × 8½ × 10	2,240
Deane Steam Pump Co.	8 × 12 × 8½ × 10	2,420

The contracts were awarded as follows: W. S. Wagner, construction work; John H. McGowan, pumps; Chandler & Taylor, boilers; Ludlow Valve Co., valves; Flower hydrants; J. B. Clow & Son, pipe and specials.

LEVEE WORK.—New Orleans, La.—Bids were opened Nov. 27 for the construction of a number of levees in the Pontchartrain levee district. Many of the bids were found to be too high, and were rejected. Local papers state that S. R. Babbitt was given the contract for the construction of the Shannon levee at 12¾ cts. per cu. yd. This embankment will be enlarged to the extent of 18,000 cu. yds. S. R. Babbitt was also given the contract for the construction of the Hollywood levee, 21,900 cu. yds., at 12.9 cts. per cu. yd. The Dupuy levee was given to F. P. Hawck at 12½ cts. per cu. yd. The levee will be enlarged to the extent of 9,700 cu. yds. The Anchor levee will be enlarged to the extent of 30,900 cu. yds., and the contract was awarded to Theo. G. Helgason at 11.85 cts. per cu. yd. St. Rose levee, 27,000 cu. yds. enlargement, was given to Lambert Bros.

SEWERS.—Scranton, Pa.—The following bids were received Dec. 4: Lateral sewer, Capouse and Larch Sts., approximate estimate of cost, 890 lin. ft., $1,424, average depth 12 ft., 275 ft. 12-in. pipe, 615 ft. 10-in. pipe, 4 catchbasins and 6 manholes—Peter F. Mulligan, Scranton, for work complete, $1,250; Hart & Gibbons, Wilkes Barre, per lin. ft., $1.59; A. H. Coon & Sons, Kingston, per lin. ft., $1.68. Hyde Park Ave. and Swetland St. lateral sewer, approximate estimate of cost, 1,105 lin. ft., $2,218, 205 ft. 20-in. pipe, 900 ft. 10-in. pipe, average depth 10.1 ft., 2 catchbasins 7 manholes—Peter F. Mulligan, Scranton, for work complete, $1,845; Hart & Gibbons, Wilkes Barre, per lin. ft., $1.03; A. H. Coon & Sons, Kingston, per lin. ft., $1.94. Jos. P. Phillips, Cy. Engr.

BRICK PAVING.—Topeka, Kan.—The contracts for paving the alley back of the new court house with brick has been awarded to H. K. Winans, of North Topeka, at $1.22 a sq. yd., and that for grading to A. K. Fulford, at 19 cts. a cu. yd. Local papers state that the city engineer's estimate was $1.33 for the paving and 25 cts. for the grading, and that the lowest bid ever before received in the city for brick paving was at $1.28 a sq. yd., the first contract for such work having been awarded at $1.78. The other bids received Nov. 26 for paving the alley were as follows: A. H. Nooney, paving, $1.23; grading, 22 cts.; John Ritchie, $1.23 and 26 cts.; C. J. Rosen, Jr., $1.33; Olof Swanson, $1.25; David McNair, $1.29 and 20½ cts.

CONDENSER.—McKeesport, Pa.—It is reported that the bids received Dec. 2 for an independent condenser for a 5,000,000-gallon pump, as advertised in Engineering News, were as follows: (1) being size of steam cylinder; (2) air cylinder; (3) stroke:

	1.	2.	3.	Price.
	ins.			
Henry R. Worthington, New York	12	14	10	$1,549
Hall Steam Pump Co., Allegheny	16	22	24	1,375
Philadelphia Engineering Works	12	12	10	2,267
Snow Steam Pump Co., Buffalo	12	18	18	1,194
Geo. F. Blake Mfg. Co., New York	16	24	24	3,400
Gunning, Stewart & Co., Pittsburg	12	16	18	920
*Deane Steam Pump Co., Holyoke	14	18	24	1,227
**Pultney Fdry. & Engine Works	18	18	18	1,688
Wilson, Snyder Mfg. Co., Pittsburg	14	22	24	2,380

* Awarded contract. ** Youngstown, O.

ELECTRIC LIGHT PLANT.—Cincinnati, O.—We are informed that the following bids were received for an electric light plant for the Hunt St. pumping station:

Card Electric Motor & Dynamo Co., Cincinnati.—For two 10 KW. 110-volt dynamos, seven 2,000-c. p. lamps, complete wiring and fixtures, switchboard, two 17-HP. Rice engines, for $1,470, or with two Houston, Stanwood & Gamble 7 × 12 engines, $1,195, or with Lane & Bodley 7-in. cylinder slide valve engine, $1,230.

General Electric Co.—Two multi-polar 1,650 generators, 20 arc lamps, wiring, fixtures, switchboard, two Houston, Stanwood & Gamble engines, 15 HP., with foundations, $1,541, without foundation, $1,417.

L. W. Davis & Co.—Two 110-arc light dynamos, switchboard, wiring, etc., two 5 × 12 Brownell automatic engines, $1,050.

Fort Wayne Electric Corporation.—Two 110-volt Wood incandescent dynamos, seven arc, 100 incandescent lamps, wiring, switchboard, etc., two 6 × 10 Rice 17-HP. engines, $1,847.

Alex. S. Schulman.—Two 8-KW. Siemens & Halske

dynamos, eight 2,000-c. p. arc lamps, wiring, switchboard, etc., two 5 × 10 automatic engines, $2,132.

Nowotny Electric Co.—Two Nowotny dynamos, seven 2,000-c. p. lamps, wiring, switchboard, etc., two 17-HP. Rice engines, $1,392.

STEEL BRIDGE.—Louisville, Ky.—Hart Vance, County Surv., received the following bids Dec. 11 for constructing a steel bridge over Fern Creek, about three miles south of Steine. The work is described as a steel bridge consisting of four 32-lb. 12-in. I's, and two 20-lb. 12-in. channels, 33 ft. long, steel lattice railings, reaching 3 ft. above floor, composed of a 6 × ¼-in. top plate, two 2 × 2-in. 3.2-lb. L's, one bottom L, 2 × 3 ins. 4.1-lb., and 1⅛ × ⅛-in. lattice bars, riveted with ¼-in. rivets at each crossing, spaces 8 ins. whole in three panels each side; 3-in. white oak floor, with 6 × 6 ins. felloe guards; each beam bolted through one flange to each abutment:

C. S. Cornwell, 3516 High Ave., Louisville	$356
Indiana Bridge Co., Muncie, Ind.	349
Toledo Bridge Co., Toledo, O.	348
The Iron Substructure Co., Columbus, O.	343
J. A. Holmboe, Columbia Bldg., Louisville	295
Louisville (Ky.) Bridge & Iron Co.,	274

PUMPING ENGINE.—Cleveland, O.—The following bids were received Dec. 11, according to local papers, for a new 20,000,000-gallon pumping engine, as advertised in Engineering News:

Southward Foundry & Machine Co., Philadelphia	$87,700
Goshon High-Duty Pumping Engine Co., N. Y.	73,000
Knowles Steam Pump Wks.,	$67,500 and 73,500
Snow Steam Pump Works, Buffalo	77,845
Wm. Cramp & Sons Ship & Engine Bldg. Co.	91,990
Henry R. Worthington, New York	58,500
Holly Mfg. Co., Lockport, N. Y.	54,690
E. P. Allis Co., Milwaukee	64,350
Kilby Mfg. Co., Cleveland	67,500

DREDGING.—Wilmington, Del.—The following bids were received Dec. 10 for dredging in Christiana River, Wilmington Harbor, as advertised in Engineering News, the price being per cubic yard, place measurement:

Frank C. Somers, Camden, N. J.	$0.19¾
Morris & Cumings Dredging Co., New York	.17½
American Dredging Co., Philadelphia	.20
Delaware Construction Co., Wilmington, Del.	.18½
Atlas Dredging Co., Wilmington	.17

ELECTRIC LIGHTING.—Bellows Falls, Vt.—A contract for street lighting for three years has been awarded to the Fall Mountain Paper Co., which has had the contract for the last five years. About 40 lights of 2,000 c. p. are used for street lighting and 3,000 incandescent lights are furnished to private consumers. The new contract is at $120 a light a year for all-night lights, and $75 for each half-night light, each light to burn every night.

PIPE SEWERS.—Fort Madison, Ia.—J. Ross Robertson, Cy. Engr., writes us that the Fort Madison Construction Co. was awarded a contract Dec. 2 for constructing 3,000 ft. of 10-in. pipe sewer, average cut 9 ft., at 15 cts. a ft., the city to furnish pipe on car.

INDUSTRIAL NOTES.

GILBERT & CO., of York, Pa., contractors, recently lost their plant by fire.

THE DEERE-WELLS IMPLEMENT CO., of Council Bluffs, Ia., recently had its plant destroyed by fire; reported loss, $200,000.

HENRY F. VOGT, of Milwaukee, Wis., a large contractor, has assigned. His assets are reported to be $75,000, and liabilities about $40,000.

THE ALABAMA LUMBER CO., of Montgomery, Ala., a consolidation of about 25 of the largest mills in the state, has completed its organization.

THE GRIFFIN CAR WHEEL CO., of Chicago, Ill., is reported as having bought the Northwestern Car Wheel & Foundry Works of St. Paul, Minn.

THE PETERSBURG IRON WORKS CO., of Petersburg, Va., has just launched the snag-boat "Roanoke." This boat is being built for the U. S. Government for use on the Roanoke River, N. C.

THE STANDARD GAGE CO., of Beaver Falls, Pa., will, it is reported, erect a new plant for the manufacture of all kinds of finished steel, embracing shafting, squares, angles; also steel for finished machined keys, etc.

THE CINCINNATI SEWER PIPE CO., of Cincinnati, O., is reported to be running to its full capacity. The company states that the demand for firebrick was never so great as now. They are now making 20,000 brick per day.

THE MEXICAN ASPHALT CO., of Chicago, Ill., has lost its case against Homer Hall and the Mexican Asphalt Co., of Kansas City, relating to its claim on certain asphalt mines in Mexico. It is stated that an appeal is likely to be made.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., has just completed for the Standard Oil Co., at Constable Hook, N. J., a compounding building 120 × 130 ft. The roof trusses are of steel, with steel purlins, and the roof is covered with galvanized corrugated iron.

THE UNION STEEL CO., of Alexandria, Ind., has replaced the section of roof which was recently blown off its sheet mill, and work has been resumed in the wrecked department. The plant now employs 1,000 hands, and when the full plant is completed 600 more will be added.

THE NILES TOOL WORKS CO., of Hamilton, O., is making an addition to its plant of another large foundry to be built of steel, brick and slate, 436 × 300 ft., and 38 ft. high to the roof trusses. Eight overhead traveling cranes will be used, with lifting capacities of from five to thirty tons.

THE COLD ROLLED STEEL WORKS at New Kensington, Pa., is reported to have been purchased by the B.H. Woodson & Co., of Massachusetts, who will operate it as a tack factory, adding 85 tack machines and using the old mill for rolling the tack stock. The mill has been idle for two years.

GRANITE QUARRIES.—According to press reports, a movement is on foot to purchase all the granite quarries at Barre, Vt., by a stock company. E. L. Smith, C. N. Field, W. A. Boyce, S. C. White, of Barre; James Gasely, of Albany, N. Y., and A. F. Sortwell, of Montpelier, Vt., are interested.

DR. F. P. VAN DENBERGH, of the Van Denbergh Laboratory of Chemical Industries at Buffalo, N. Y., has been retained by the Baldwin Fertilizer Works as Consulting Chemist in connection with some improvements contemplated, and is now making an examination of the works at Port Royal, S. C.

BLAST FURNACES.—A report from Ishpeming, Mich., states that the Excelsior Furnace has largely increased its output; that the Cleveland Cliffs Co. will soon blow in its large charcoal furnace; that the Western furnace at Manistique is arranging to go into blast, and that the Martet furnace at St. Ignace will resume at once.

J. W. HOFFMAN & CO., of 42 Wall St., New York, N. Y., have been awarded the contract for building the new pier 96, South Delaware River, Philadelphia, Pa., for the Franklin Sugar Refining Co. This pier will be 548 ft. long and 76 ft. wide, built on pile foundations and steel superstructure, piles to be cut off at low water-line.

THE NATIONAL TUBE WORKS CO., of McKeesport, Pa., has suspended operations at its works at Riverton, and in the butt weld department, until after the holidays, that necessary repairs may be made. It is stated that the company will soon enlarge its plant, and that the galvanizing works will be removed to Versailles.

THE MACK MFG. CO., of New Cumberland, O., is changing its Eagle works to make sewer pipe instead of brick. The company here owns four works for the manufacture of brick and three for sewer pipe. The company reports that business is improving. It has recently shipped large orders for paving brick to New Orleans and Louisville, Ky.

HOYLE & ABBOTT, National Bank Bldg., Atlanta, Ga., is the firm name of a new railway supply house organized to deal in general railway and electrical equipment. Mr. Frank J. Hoyle is extensively and favorably known among the railway people of the South and East, and Mr. Charles A. Abbott has had a long experience as member of a well-known firm of corporation attorneys.

THE NORTHWESTERN IRON & STEEL CO., of West Superior, Wis., has another plan of reorganization, whereby the bondholders have appointed a committee with full power to act, the plan being to allow the old stockholders to come into the new company as preferred creditors, and the other unsecured creditors to take common stock for their claims and put in $200,000 in cash. The plant is then to be operated in connection with the West Duluth blast furnace and the American Steel Barge Co.

THE GATES ELECTRIC MFG. CO., of Chicago, Ill., recently installed a 75-HP., 500-rev. motor in the works of Fraser & Chalmers, Chicago, for the operation of a large Root blower for blowing the cupolas. The company informs us that Mr. John Walker, Manager of the Fraser & Chalmers works, in a recent letter to a company contemplating the installation of a similar motor, stated that the Gates Co. had supplied a machine with greater capacity and efficiency than was contracted for. The Gates Co. also reports an active trade in electrical apparatus for mines, street railways and lighting plants.

THE WHITING FOUNDRY EQUIPMENT CO., of Chicago, Ill., report having made recent shipments of the Whiting cupola as follows: One test cupola to the University of Illinois, at Champaign, Ill.; one 14-ton per hour cupola to the Globe Iron Works, Cleveland, O.; five-ton cupolas to the Hazleton Iron Works, Hazleton, Pa.; Cornish, Curtis & Greene, Ft. Atkinson, Wis.; J. M. Saville & Sons, Canton, Ill., and one 12-ton per hour cupola to the Ames Iron Works, at Oswego, N. Y. The company recently shipped two 20-ton and two 15-ton ladles for the plants connected with the American Steel Casting Co., at Alliance and Pittsburg.

THE PACIFIC CABLE CO. was incorporated at Trenton, N. J., on Dec. 16, with a capital of $1,000,000. The names of the incorporators and the shares held by each are: Abram S. Hewitt, of New York, 1,500 shares; D. O. Mills, of New York, 1,000 shares; G. M. Dodge, of New York, 1,000 shares; Fred D. Grant, of New York, 500 shares; Wager Swayne, of New York, 500 shares; James J. Hill, of St. Paul, Minn., 1,000 shares; Z. S. Spalding, of San Francisco, 2,500 shares; John H. Browning, of Tenafly, N. J., 1,000 shares, and Mason W. Tyler, of Plainfield, N. J., 1,000 shares. The object of the corporation is stated in the papers filed to be the construction and operation of electric submarine cables in the Pacific Ocean, with telegraph lines and connections for the transmission of messages. Connection, it is understood, will be made with the Hawaiian Islands. Offices are to be maintained in Jersey City and San Francisco, and business will be commenced on Jan. 1 next. Mayor Hewitt said to a reporter of the New York "Sun" that the basis of the scheme is a concession granted to Colonel Spaulding, of Hawaii, by the government of that island, for a cable to the United States, carrying with it a subsidy of $40,000 per year. As the estimated annual cost of maintenance for such a cable is about $300,000, Colonel Spaulding proposes to apply to Congress for a further subsidy, sufficient to warrant the laying of the cable and to pay for maintenance. The organizers will be ready at any time to turn the cable over to the United States on payment of the actual cost of construction; their main object, says Mayor Hewitt, being to secure to this country the advantages of a cable, in the hope that it may be extended to Australia and to China.

NEW COMPANIES.—Union Foundry Co., Rochester, N. Y.; $10,000; E. R. Trimble, C. H. Bird, M. B. Trimble, and M. A. Bird.

Westchester Dredging Co., New York, N. Y.; $50,000; Wm. B. Duncan, Jr., Angus McIntosh and Samuel F. Lynch.

The Barnum Boiler Cleaner Co., Cleveland, O.; $20,000; John N. Barnum, John H. Barnum, Wm. H. Hower and A. M. Crowl.

New Britain Machine Co., New Britain, Conn.; $250,000, with $89,000 paid in; Philip Corbin, F. G. Platt, M. C. Swift and others.

The Alexander Nut-Lock Mfg. Co., New York city; $20,000; M. H. Alexander, John W. Johnston, R. R. Brown, of New York city.

North American Alkali Co., York, N. Y.; $1,000,000; J. M. Horton, Wm. Foster, W. J. Foster, of New York, N. Y., and W. B. Orent, of Chicago.

Northumberland Stone Co., Shediac, N. B.; $10,000; James Frier, Foster Pickard, of Shediac; B. B. Teed, of Sackville, and Le Blanc, of Botsford.

The Indianapolis Wrench & Stamping Co., Indianapolis, Ind.; $10,000; Charles Meggenhoffen, Harry E. Reeves, Charles M. Bundy and others.

The Chautauqua Veneer & Panel Co., Gerry, N. Y.; veneer panels for cars, interior work, etc.; J. K. Wilson, Joseph Trusler, Oscar Partridge and others.

Thompson Lumber Co., Augusta, Ga.; to manufacture lumber, ice, etc.; $30,000; Jesse Thompson, Jr., J. H. Wellington, L. W. Woodward and B. M. Youngblood.

The Elmwood Cycle Mfg. Co., New York city; $12,000; Wilber E. Goodwin, of Elmwood, Conn.; Frank S. Parmalee, Clarence B. Marter and Louis Brass, of New York city.

The Maryland Mfg. & Construction Co., Baltimore, Md.; to manufacture all kinds of machinery; $100,000; S. D. Warfield, Henry B. Keyser, Jacob Epstein, John K. Cowen and others.

The Keystone Structural Co., Royersford, Pa.; to manufacture, sell and erect structural work in iron and steel; $50,000, with $5,000 paid in; Treas., Horace E. Campbell, of Pottstown, Pa.

The Coughlin-Sanford Switch Co., of Baltimore, Md.; $500,000; to manufacture an "improved switch"; Edward C. Coughlin, Harry C. Sanford, T. Noel Poullain, Chas. Field and John J. Middleton.

The Mechanical Designing & Mfg. Co., Jersey City, N. J.; $100,000 all paid in; Arthur E. Hotchkiss, Brooklyn, N. Y.; Harry W. Green, Jersey City, and Herbert F. Hatch, of East Orange, N. J.

New Jersey Smoke & Vapor Condensing Co., Newark, N. J.; $150,000, all paid in; Albert W. Mockridge, Jersey City, N. J.; Ebenezer A. Smith Montclair, N. J., and George N. Mockridge, Newark, N. J.

The Wilson Oil & Gas Co., Bolivar, N. Y.; to operate oil and gas wells in the states of New York, Ohio and Pennsylvania; $50,000; E. J. Wilson, Alex. Wilson, Frank Burns, and others, of Bolivar.

Long Island Illuminating Co., Brooklyn, N. Y.; $100,000; Charles A. Lockwood and Robert F. Rhodes, of Jamaica, N. Y., and Joseph H. Holmes, Jay P. Jones and Eugene E. Seaman, of Brooklyn.

The American Car Sprinkler Co., Worcester, Mass.; to manufacture and deal in street cleaning and sprinkling devices and supplies, etc.; Pres., F. M. Wellington; Treas., Alfred Thomas; Secy., Frank D. Perry.

The Jones Direct Process Steel Co., Jersey City, N. J.; $100,000, with $1,000 paid in; Henry A. Jones, Brooklyn, N. Y.; James G. Beemer, Yonkers, N. Y.; Joseph C. Davis, Maplewood, N. J.; F. W. Slope, Red Bank, N. J.

The Atlanta, Knoxville & Northern Ry. Construction Co., of New York city; to deal in railroads and railroad equipments; $92,000; Matthew McLanahan and George Mumford, of New York, and Chas. E. Kimball, of Summit, N. J.

New Jersey Carbide & Acetylene Gas Co., Camden, N. J.; $3,000,000, with $21,000 paid in; Benjamin F. Archer, Chas. I. Fering, Camden, N. J.; Henry M. Gratz, Anthony M. Zane, Wm. K. Park, of Philadelphia, and others.

The Carteret Steel Co., Woodbridge, N. J.; $1,000,000, with $1,000 paid in; Henry A. Jones and Chas. H. Dewey, of Brooklyn; Jas. G. Beemer, Yonkers, N. Y.; Joseph C. Davis, Maplewood, N. J., and F. W. Slope, Red Bank, N. J.

The National Fencing Co., Fultonville, N. Y.; to manufacture wire, wire fencing, gratings, guards, etc.; $100,000; John D. Wendell, Frank Emory Bakeman and Wm. Clark, of Fort Plain; Robert Wemple, H. W. Post, A. Z. Wemple and others, of Fultonville.

Kaltenbeck Car Fender Mfg. Co., Passaic, N. J.; $400,000, with $300,000 paid in; Wm. H. Kaltenbeck, Roxbury, N. Y.; Charles C. Kaufman and Thomas Winter, of Margaretville, N. Y.; Frank Kaufman, Kingston, N. Y., and Everett Kaufman, of Passaic, N. J.

The Maryville Canal & Improvement Co., Idaho Falls, Idaho; to operate a canal to be taken out of Falls River, in Fremont county; $180,000; R. Rounds and W. C. Chaney, of Idaho Falls; J. H. Brady, Kansas City, Mo.; F. W. Smith, Chicago, and H. A. Marysville, Idaho.

The Standard Oil Extracting & Refining Co., of Jersey City, N. J., and New York, N. Y.; to deal in wool, fibrous materials, oils and fats; $1,000,000, all paid in; Wm. M. Deens, Short Hills, N. J.; Geo. W. Dresser, Boston; Henry B. McDowell, of New York, and Geo. Wakeman, of Danbury, Conn.

Linehan Railway Transfer Co., Dubuque, Ia.; to build, equip, and operate railway transfer steamers, ferryboats, barges, etc., at points on the Mississippi River between New Orleans and St. Paul; $500,000, with $300,000 paid in; Bart E. Linehan, T. M. Linehan, W. S. Molo, W. J. Browne, and Geo. W. Kiesel.

The Syracuse Gas Co., Syracuse, N. Y.; to manufacture gas and electricity for light, heat and power; $2,500,000; Robert C. Pruyn, of Albany; Stephen Peabody, Emerson McMillin and others, of New York city; Wm. L. Elkins, Jr., Philadelphia; James J. Belden, Chas. M. Warner, Hamilton S. White and others, of Syracuse.

Utah Mining & Mfg. Co., Salt Lake City, Utah; to do a mining business, manufacture mining machinery, deal in real estate, etc., in the United States and Dominion of Canada; $50,000; Charles P. Watterson, Geo. W. Clawson, of Farmington, Utah; Chas. G. Erickson, of Murray, Utah; Chas. Bonnington, J. W. Earley and others, of Baker City, Ore.

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